CONSTRUCTION BID DOCUMENTS

NARRATIVE

CT/Radiology Room for Emergency Department

Project No. 595-11-126

Lebanon VA Medical Center
Lebanon, PA

Miller-Remick LLC
1010 Kings Highway South
Building One – 1st Floor
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March 27, 2013

Miller-Remick LLC
M.E.P. & Structural Engineering
A Service Disabled Veteran Owned Small Business

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   - International Fire Code (IFC)
   - International Fuel Gas Code (IFGC)
   - International Mechanical Code (IMC)
   - International Plumbing Code (IPC)

   .3 International Existing Building Code 2009 Edition or Chapter 34 of IBC as selected by Design Professional

   .4 International Fire Code 2009 Edition (as referenced by IBC-2009)

   .5 NFPA 99 - Healthcare Facilities

   .6 NFPA 101 - Life Safety Code, 2009 Edition

   .7 NFPA 13 - Standard for the Installation of Sprinkler Systems

   .8 NFPA 72 - National Fire Alarm and Signaling Code

   .9 Guidelines for the Design and Construction of Healthcare Facilities, 2010 Edition

2. APPLICABLE NATIONAL STANDARDS

   .1 Barrier Free Design Guides that exceeds minimums of the Architectural Barriers Act (ABA) and the Americans with Disabilities Act (ADA) for healthcare projects.

3. APPLICABLE OWNER GUIDELINES

   .1 Architectural Design Manual, August 2011 Edition

   .2 A/E Submission Instructions for Minor and NRM Construction Program

ARCHITECTURAL DESIGN

1. CT SCANNING (ROOM XCTS1)

.1 Convert area in existing Building 101 into a CT Room. The CT Room can be accessed on both sides from the two adjacent corridors. The room has direct access to a dedicated control room.

.2 Areas:

- CT Room: 447 sf
- Total Net Area: 447 sf

.3 Scope of Work (all rooms unless noted otherwise)

- New VCT (remove existing flooring and adhesives, shot blast concrete floor, install new vinyl composition tile floor and rubber base).
- New Acoustical Ceiling Panels in suspended grid system. Ceiling height: 9'-0"
- Gypsum Board walls to receive paint finish. Shielding as required within gypsum board walls.
- Corner protection on all exposed corners.
- Shielded doors into the CT Scanning Room.
- Shielded viewing window to Control Room.
- High pressure laminate casework.

.4 Details

- Demolish existing walls, doors, and flooring
- Construct new rated partitions along corridor. Gypsum partitions to receive shielding.
- Install new shielded doors and window. Install new VCT flooring, casework, and sink. Paint gypsum board walls.
- Install CT equipment, including necessary ceiling tracks and supports.

2. CONTROL ROOM (ROOM XCTC1)

.1 Convert area in existing Building 101 into a Control Room. The Control Room can be accessed from the adjacent CT Room. The room is equipped with built in casework for computer monitors and equipment. A viewing window allows staff to observe both the CT Room.

.2 Areas:

- Control Room: 127 sf
- Total Net Area: 127 sf

.3 Scope of Work (all rooms unless noted otherwise)

- New VCT (remove existing flooring and adhesives, shot blast concrete floor, install new vinyl composition tile floor and rubber base).
- New Acoustical Ceiling Panels in suspended grid system. Ceiling height: 9'-0"
- Gypsum Board walls to receive paint finish. Shielding as required within gypsum board walls.
- Corner protection on all exposed corners.
- Shielded viewing window into the CT Scanning Room.
- High pressure laminate casework.

.4 Details

- Demolish existing walls, doors, and flooring
- Construct new rated partitions along corridor. Gypsum partitions to receive shielding.
- Install new shielded doors and window. Install new VCT flooring and casework. Paint gypsum board walls.

3. RADIOLOGY ROOM (ROOMS XDR01)

.1 Convert area in existing Building 101 into a Radiology Room. The Radiology Room can be accessed on both sides from the two adjacent corridors. The room has direct access to a dedicated control room.

.2 Areas:

- Radiology Room: 478 sf
- Total Net Area: 478 sf

.3 Scope of Work (all rooms unless noted otherwise)

- New VCT (remove existing flooring and adhesives, shot blast concrete floor, install new vinyl composition tile floor and vinyl base).
- New Acoustical Ceiling Panels in suspended grid system. Ceiling height: 9'-6"
- Gypsum Board walls to receive paint finish. Shielding as required within gypsum board walls.
- Corner protection on all exposed corners.
- Shielded door into the Radiology Room.
- Shielded viewing window to Control Room.
- High pressure laminate casework.

.4 Details

- Demolish existing walls, doors, and flooring.
- Demolish existing exterior window and prepare walls for new window installation.
- Construct new rated partitions along corridor. Gypsum partitions to receive shielding.
- Infill portions of existing walls as necessary.
- Install new shielded doors and windows. Install new VCT flooring, casework, and sink. Paint gypsum board walls.
- Install XRAY equipment, including necessary ceiling tracks and supports.

CHAPTER 2

HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

1. GENERAL

.1 This project will provide for the renovation of existing waiting, check-in, and security areas, and an existing triage room, into a new CT scanning room (with integrated control room area) and a new X-Ray room (with integrated control room area) for the emergency department at the VA Medical Center in Lebanon, PA.

2. SCOPE

.1 The renovation will include the following scope:

- A new dedicated air handling unit (AHU) will be installed on the roof above the project area to serve the renovated area. Each new room will be designed to meet current VA design requirements.

3. EXISTING CONDITIONS

.1 Building 101

- (2) Rooftop AHU's, RT-1 and RT-2, each located on the roof above adjacent spaces, serves the area that makes up the new project scope boundary. Distribution ductwork and piping run above the new project area.

- Exhaust fan EF-5, located on the roof above the new project area, serves the existing-to-remain toilet rooms, electrical closet, housekeeping closet, and waiting area. Distribution ductwork runs above the new project area.

- Exhaust fan EF-6, located on the roof above the new project area, serves the existing-to-remain breakroom adjacent to the project area. Distribution ductwork runs above the new project area.

4. DESIGN APPROACH

.1 Each area was analyzed for design approach requirements in the DVA, 'HVAC Design Manual for New, Replacement, Addition, and Renovation of Existing VA Facilities,' for *Imaging Series – Radiology Services*. The following preliminary design approach will be utilized for the new rooms:

.2 **General**

- Outdoor design conditions: 92.4 degree F DB, 73.8 degree F WB (summer); 0 degree F DB (winter)
- Indoor design conditions: 75 degree F (cooling); 70 degree F (heating).
- Indoor relative humidity: In order to maintain the spaces within a range of 20% to 60% relative humidity during all seasons, a "clean steam" humidifier will be provided in the AHU.
- Minimum total air changes per hour (ACH): 12 ACH (CT and Control rooms); 6 ACH (X-Ray room).
- Minimum outside air changes per hour (ACH): 2
- Filtration to consist of the following: Pre-filter (MERV 7); Pre-filter (MERV 11); Final filter (MERV 14)
- There will be no redundancy built into the design of the project.
- New DDC controls to tie into existing building/site Delta control system.
- Refer to Appendix for load calculations and AHU cut sheets.

.3 **Roof –** New AHU

- A new 2,700 cfm variable volume, return air, AHU will be designed to serve the renovated area. The unit will be mounted on steel dunnage, located on the roof directly above the space adjacent to the project area currently occupied by Waiting.
- The new unit will consist of the following components; Return Fan, Mixing Box, Pre-filter, LPS Integral Face and Bypass Preheat Coil, Chilled Water Cooling Coil, "Clean Steam" Humidifier, Supply Fan, Final Filter, and Discharge Plenum. VFD's will be added to the unit's supply and return fans and located within the external housing on the roof on the unit. Refer to Appendix for AHU dimensional drawings.
- A chilled water coil freeze protection pump will be provided across the chilled water supply and return lines to/from the AHU and will be located above the adjacent waiting room ceiling.
- The AHU will be located so that outside air intake will be 25'0" from any exhaust points. Refer to drawings.

.4 **Ground Floor –** New CT and X-Ray Rooms

- *CT Room and Associated Control Area* – Will be served by a single supply VAV control box with an integral hot water reheat coil for temperature control. An additional hot water reheat coil will be installed in the branch duct to the control area for supplemental heating. Air will enter the room through ceiling mounted diffusers and exit the room through ceiling mounted return grilles. Laminar flow diffusers will be provided to match the recent CT room renovation in adjacent building.
- *X-Ray Room and Associated Control Area* - Will be served by a single supply VAV control box with an integral hot water coil for temperature control. Air will enter the room through ceiling mounted diffusers and exit the room through ceiling mounted return grilles.
- Hot water reheat coils will be fed from rerouted branch lines, located above the ceiling, within the project area. Per discussion with the VA, the discharge air temperature for the reheat coils will be 110 degrees.
- Existing branch ductwork and piping serving the current check-in, security, and triage areas will be capped back at the nearest mains.
- The new spaces will not be designed for individual humidity control.
- Per the VA, commercial, duct-mounted, in-line, elbow sound attenuators installed above the waiting area ceiling at the inlet and discharge of the AHU, will not be required for sound control. Sound control to be accomplished by addition of ductwork elbows upstream of RA inlet to AHU, and downstream of SA outlet from AHU.
- Room pressurization will be positive per the VA standards. An offset between supply and return air quantities will maintain positive air pressurization within each space. Existing EF-5 will be rebalanced to accommodate the resultant additional transfer air into the waiting area. A new return air branch and return grille will return the resultant additional transfer air into the adjacent corridor back to the new AHU.

.5 **Control Scheme**

- An option for not providing individual room VAV boxes, in lieu of allowing the AHU to effectively be controlled as a single large VAV box, was discussed during the previous design phase and it was decided to not pursue this option.
- Per discussion with the VA, the AHU will be controlled so that when the outdoor air temperature is 30 degrees and below, the AHU leaving air temperature will be set to 55 degrees. When the outdoor air temperature is

80 degrees and above, the AHU leaving air temperature will be set to 55 degrees.

- During normal occupied hours the AHU will operate as a constant volume system. During nighttime unoccupied hours, the unit will have the capability to be controlled to 50% of system flow.

- Per discussion with the VA, control sequences as indicated on drawings, are for bid pricing only. Final control sequences to be per VA.

6. HEATING PLANT

.1 The existing Lebanon VA Medical Center utilizes high, medium, and low pressure steam as a medium to supply heat to the various systems throughout the campus. Steam piping is run to each building through a series of tunnels and crawl spaces.

- The heating plant for Building 101 is located in the basement of adjacent Building 1. MPS/MPC, heating hot water and "clean steam" are brought to Building 101 through the crawl space below Building 1.

- MPS/MPC is utilized for existing roof mounted RTU preheat coils. These branch lines, located above the ceiling, outside of the project area, will be tapped for the new AHU being provided as part of this renovation project. Refer to Appendix for quantities required.

- "Clean Steam" is utilized for existing roof mounted RTU humidifiers. These branch lines, located above the ceiling, outside of the project area, will be tapped for the new AHU being provided as part of this renovation project. Refer to Appendix for quantities required.

7. COOLING PLANT

.1 The existing Lebanon VA Medical Center utilizes chilled water as a medium to supply cooling to the various systems throughout the campus. Chilled water piping is run to each building through a series of tunnels and crawl spaces. Existing branch lines located above the ceiling, outside of the project area, will be tapped for the new AHU being provided as part of this renovation project. Refer to Appendix for quantities required.

CHAPTER 3

ELECTRICAL

1. GENERAL

.1 This project will provide for the renovation of existing waiting, check-in, and security areas, and an existing triage room, into a new CT scanning room (with integrated control room area) and a new X-Ray room (with integrated control room area) for the emergency department at the VA Medical Center in Lebanon, PA.

2. SCOPE

.1 The renovation and expansion of storage areas include the following scope:

- Lighting: The CT scanning room and radiology room will have general lighting consisting of recessed fluorescent lay in fixtures with acrylic prismatic lenses. The room will be illuminated to 50 foot candles. Special incandescent lighting will be provided by recessed 8 inch down light fixtures. The incandescent fixtures will be on a dimmer switch and reduce levels down to five foot candles. The fixtures will be located to avoid direct glare for patient comfort. X ray and CT in use warning lights will be provided at the exterior doors. All lighting will be connected to emergency power to continue operations in the event of normal power loss.

  The control rooms will have general lighting consisting of special incandescent lighting provided by recessed 8 inch down light fixtures. The rooms will be illuminated to 30 foot candles. The incandescent fixtures will be on a dimmer switch and reduce levels down to five foot candles. All lighting will be connected to emergency power to continue operations in the event of normal power loss.

  Waiting room lighting will consist of lay in fixtures with acrylic prismatic lenses. The room will be illuminated to 50 foot candles. Emergency lighting will be provided from the nearest life safety panel.

  LED exit signs will be provided in the corridors and waiting room to direct routes of egress. They will be connected to the nearest life safety panel.

- Power Distribution: Based on the estimate loads, a new emergency equipment 480V, 150A feed will be required to serve the major equipment

to include the CT, X Ray, and AHU. The new panelboard will be located in the control room. The source of normal power for the new panelboard will be fed from the Building 103 Main Switchboard MSB103. The source of emergency power for the new panelboard will be fed from the Building 103 Generator Paralleling Switchboard GPSB103. Transfer of normal and emergency power will be achieved with a new 4 pole, closed transition, 150A automatic transfer switch (ATS) with isolation bypass located in Building 103 Main Electrical Room. The feed from the ATS will be routed in an existing 3 ½" conduit that stubs up in the vicinity of the new CT/Radiology renovation.

Emergency lighting and miscellaneous power will be fed from the existing emergency panels located in electrical room 136.

- Convenience Receptacles: Convenience receptacles shall be provided in accordance with the VA design guide placement of receptacles for CT rooms, radiology rooms, and control rooms. Control desks will be provided with receptacles above and below the desk for console equipment. All convenience receptacles located in the CT room, radiology room, and control room will be connected to emergency power. The waiting room will be provided with a convenience receptacle for cleaning.

- Mechanical Systems: All new mechanical systems will be provided with new branch circuits and local disconnect switches as required in accordance with VA Electrical Design Standards. Equipment will be connected to emergency power.

- Phone and Data: Phone and data outlets will be provided in accordance with VA electrical design guide for CT rooms, radiology rooms, and control rooms. All data and phone outlets shall be tied into the building's existing system.

- Nurse Call: Code blue dome lights shall be provided at the doors of the CT and Radiology rooms. Code blue nurse call stations shall be provided in the CT and Radiology control rooms and their respective patient treatment areas.

- Electrical Loads:

Lighting:	5kVA (fed from ELEC 136)
Power:	4.2kVA (fed from ELEC 136)
CT:	20kVA
X Ray:	2.6kVA
AHU:	13.1kVA

Total Emergency Load on New Panel: 44.9kVA

- Emergency power: The following equipment shall be placed on emergency power:

  - Convenience receptacles in CT, radiology, and control rooms.

  - Lighting in CT, radiology, waiting, and control rooms.

  - The new AHU serving the new rooms.

  - The CT scanner and X Ray.

- Method of short circuit calculations: The method of short-circuit analysis will be calculated with SKM software. The DAPPER Comprehensive Fault Analysis program provides a network solution of three-phase, single-line to ground, line-to line, and double line to ground fault currents; RMS momentary fault currents; asymmetrical fault duties at three, five, and eight cycles; the positive, negative, and zero sequence impedance values between each fault location, and contributions from utilities, generators, and motors. At each fault location, the direction, X/R, and magnitude of fault currents are reported, thus providing a clear view of the conditions that exist during the fault.

- Method of voltage drop and demand calculations: The method of voltage drop and demand analysis will be calculated with SKM software. The DAPPER module calculates the voltage drop on each feeder and transformer branch, voltage on each bus, projected power flow, and losses in the power system. The program is be used for conventional voltage drop analysis, loss analysis, power factor studies, capacitor placement, long-line charging effects, impact loading for motor starting studies, generator sizing, and for cogeneration analysis. The DAPPER module calculates a single load flow program models loop and radial power systems.

- Utility Company Correspondence: There is no utility company correspondence or requirements required for this project. A new electrical service will not be provided by the utility company. All power for the new renovation will be provided from the existing VA building distribution system.

CHAPTER 4

PLUMBING

1. GENERAL

.1 The plumbing systems will be in accordance with the DVA Plumbing Design Manual; Revised April 2010.

.2 The plumbing codes and standards planned to be utilized are the latest editions of:

- International Building Code (IBC)
- International Fire Code (IFC)
- International Mechanical Code (IMC)
- International Plumbing Code (IPC)

2. EXISTING CONDITIONS

Currently the CT/Radiology renovation at Building 101 of the Lebanon VA Medical Center is provided with a potable water and sanitary drainage system for plumbing fixtures, storm drainage system and medical air, vacuum and oxygen service capped for future within the area. These existing plumbing fixtures and associated piping systems within the renovated areas are to be removed back to the mains and capped.

3. DESIGN APPROACH

.1 Potable Domestic Water Service:

- Within the renovated areas domestic hot and cold water will be extended from the existing piped distribution systems to new sinks.
- All domestic hot water and cold water piping shall be type "L" seamless copper tubing, for use with solder type fittings. Fittings for copper tubing shall be wrought copper or cast bronze. Valves for copper tubing shall have bronze bodies. Solder used in the domestic water systems shall be "lead-free" type containing less than 0.2 percent lead content. All piping shall be insulated and labeled every 20’-0”.
- All plumbing piping and appurtenances shall be braced and anchored for seismic requirements in accordance with the 2009 International Building Code, SMACNA requirements, and NFPA recommendations.

.2 Sanitary Waste and Vent system:

- All new sink drains will be provided with a DWV copper piped gravity drainage system into the existing sanitary waste system below the existing slab and existing vent piping above the finished ceiling.
- All plumbing piping and appurtenances shall be braced and anchored for seismic requirements in accordance with the 2009 International Building Code, SMACNA requirements, and NFPA recommendations.

.3 Medical Gas and Vacuum systems:

- Medical oxygen and vacuum required at outlets in the CT Scanning and Radiology rooms will be supplied from the existing capped medical oxygen and vacuum piping near the waiting room. These lines will be provided with a zone valve box. Piping shall be installed and certified to meet the requirements of a Level I Medical Piped Gas and Vacuum System in accordance with NEPA 99C 200d Gas and Vacuum Systems, NFPA 99 Health Care Facilities, and 2006 AIA Guidelines for Design Construction of Hospital and Health Care Facilities.
- Medical oxygen and vacuum piping shall be constructed of Type K or L, ASTM B819 Medical Gas Tube Service copper tube with brazed joints per NFPA 99C, Service, zone, and in-line valves shall be located in accordance with NFPA 99C. Zone valve boxes, pressure switches, and alarms shall be located as specified and in accordance per NFPA 99C. Identify piping and valves as per NFPA 99C. Piping shall be supported in accordance with MSS SP-58 and 69.
- Piping shall be seismically protected in accordance with the 2006 IBC. Piping shall connect to existing mains in ceiling.
- Medical gas station wall and ceiling outlets shall be made of brass, securely mounted, and self-sealing in accordance with NFPA-99C and UL listed. Station outlets shall be equipped with non-interchangeable quick disconnect couplers.
- Medical oxygen and vacuum systems shall be tested and certified in accordance with NFPA-99 requirements.

4. WATER USAGE

.1 Plumbing design of the new domestic water system will employ water saving techniques to reduce the amount of potable water usage. Low flow fixtures will be used as a water usage reduction measure in order to meet the minimum sustainable design requirements set forth by the VA.

.2 Maximum flow rates and consumption for select plumbing fixtures that will be included in this project are:

- Lavatories: 0.5 Gallons Per Minute (GPM).
- Sinks: 2.5 Gallons Per Minute (GPM).

5. PLUMBING FIXTURES

.1 Exact plumbing fixture types and locations will be coordinated as room configurations are finalized. The following plumbing fixtures are referenced in the VA Design Manual PG-18-10, Plumbing Design Manual:

P-Number	Description
402	Lavatory
528	Sink

CHAPTER 5

FIRE PROTECTION

1. GENERAL

.1 The fire alarm and fire protection systems will be in accordance with the DVA Fire Protection Design Manual; Sixth Edition; Revised September 2011.

.2 The fire protection codes and standards planned to be utilized are the latest editions of the National Fire Codes (NFC) as published by the National Fire Protection Association (NFPA) and VA guide lines. Where fire alarm or fire protection features are not addressed by the NFC, the International Building Code (IBC) or other referenced standard shall be used. For the renovations, the following NFC standards for the base code references.

- NFPA 101 – Life Safety Code
- NFPA 13 – Standard for the Installation of Sprinkler Systems
- NFPA 72 – National Fire Alarm and Signaling Code

Should the codes from the International Code Council (ICC), need to be consulted, the following form the base code references.

- International Building Code (IBC)
- International Fire Code (IFC)
- International Fuel Gas Code (IFGC)
- International Mechanical Code (IMC)
- International Plumbing Code (IPC)

2. EXISTING CONDITIONS

.1 The design of the CT/Radiology renovation at Building 101 of the Lebanon VA Medical Center will integrate into the systems and services of the project.

- Fire Alarm System – Proposed/new initiation devices and notification devices are connected to the FACP either directly or through Fire Alarm Terminal Cabinets (FATC) located in the Lobby floor. The existing fire alarm system is addressable, and any new devices will be compatible with the addressable system.
- Fire Protection System – The existing wet pipe sprinkler system will be modified as necessary to support the proposed renovated areas new functions.

3. DESIGN APPROACH

.1 Fire Alarm System:

- The fire alarm system for the renovation will connect to, and extend from, the existing building fire alarm system.

.2 Fire Protection System:

- The renovated building areas are currently equipped throughout with an automatic sprinkler system in accordance with the requirements of NFPA 13.

Where possible existing heads well be relocated as required and additional heads installed if needed to provide required coverage for the new architectural layout.

- The renovated areas shall be designed as an NFPA 13, Light Hazard system hydraulically calculated utilizing the area density method by the contractor for 0.10 gpm per sq.ft over 1500 sq.ft. Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply (to be determined).
- The fire protection system shall utilize all Schedule 40 pipe and fittings except within the CT Scanning room which will be provided with copper piping. All other components shall be rated for 300 psi. Sprinkler heads in areas with acoustic tile ceilings shall be chrome plated, recessed heads with chrome plated escutcheons. Areas with unfinished exposed ceilings will be provided with rough brass upright heads. Sprinklers throughout to be ordinary temperature rated except for electrical rooms/closets shall be intermediate temperature rated and mechanical rooms to be provided with high temperature rated heads.

CHAPTER 6

STRUCTURAL

1. General Item: It has come to the attention of the design team that construction of new multi-story buildings, under separate projects, adjacent to the existing one-story Building 101 is proposed. These proposed adjacent buildings may cause an increase in the roof loading due to snow drifts. The existing roof structure of Building 101 should be analyzed to determine its capacity to support any increased snow loading.

2. Applicable Codes and Standards

    - International Building Code – 2009 Edition
    - American Society of Civil Engineers - Minimum Design Loads for Buildings and Other Structures - ASCE 7-05
    - Department of Veterans Affairs Seismic Design Requirements H-18-8
    - VA Program Guide PG-18-15 Volume C
    - VA Structural Design Manual For Hospital Projects - August 2009
    - American Concrete Institute - Building Code Requirements for Structural Concrete – ACI 318-08
    - American Institute of Steel Construction - Manual of Steel Construction – Thirteenth Edition - AISC 360-05
    - American Welding Society - Structural Welding Code for Steel – ASW D1.1
    - American Society for Testing and Materials – ASTM Standards

3. Design Loads

    1. Dead loads for the purpose of structural design are the actual self-weight of the permanent building construction materials. In addition to the self-weight of the structure, the following additional dead loads will be included in the design:

        - Rooftop HVAC Unit: 5,500 LBS (+/-) on Roof
        - CT Machine: 5,500 LBS (+/-) on Slab
        - X-Ray Machine: 2,500 LBS (+/-) on Slab

          750 LBS (+/-) on Underside of Roof

2. Design live loads to be supported are as follows:

- Radiology Service 250 PSF on Slab

3. Snow Load:

- Ground Snow Load (Pg) 30 PSF
- Snow Importance Factor (Is) 1.2
- Exposure Factor (Ce) 1.0
- Thermal Factor (Ct) 1.2

4. Wind Load:

- Basic Wind Velocity 90 MPH (3-second gust)
- Exposure Category B
- Wind Importance Factor (Iw) 1.15

5. Seismic Load:

- Occupancy Category IV
- Seismic Importance Factor (Ie) 1.5
- 0.2 Second Spectral Response Acceleration Ss 0.228g
- 1.0 Second Spectral Response Acceleration S1 0.057g
- Soil Site Classification C
- Seismic Design Category C
- Seismic Force-Resisting System: Steel Braced/Moment Frames
- Analysis Procedure: Equivalent Lateral Force

6. All load combinations shall be in conformance with listed codes and standards.

4. Structural Systems

1. Foundation System: The proposed CT and X-Ray units are to be supported on the existing concrete slab on grade.

2. Superstructure:

- The proposed X-Ray unit requires components to be supported from the underside of the roof structure. The existing roof is composed of metal deck supported on steel open-web joists, which are in turn supported on steel beams. Any suspended loads will be supported from the chords of the existing joists. Additional steel angle web members may be added to reinforce existing joists at point load locations. Additional steel framing will be added as required, based on the loading and support requirements of the selected equipment.

- The proposed rooftop HVAC unit will be supported on a steel dunnage frame. This frame will be constructed above the existing roof structure, and will be supported from existing steel columns. These existing columns will be extended through the roof to support the steel dunnage framing. Additional steel framing will be added to the existing roof structure to allow mechanical penetrations.

3. Structural System Selection: The structural system was selected as the optimum structural system for the equipment requirements.

5. Structural Materials

1. Concrete

- Minimum Compressive Strength: f'c=4,500 psi

- Maximum Water-Cementitious Materials Ratio: 0.45

- Minimum Cementitious Materials Content: 500 lb/cu. yd.

- Air Content: 4.5 to 5.5 percent

- Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

- Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Maximum Coarse-Aggregate Size: 1 1/2 inch nominal.

- Air-Entraining Admixture: ASTM C 260.

- High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

2. Structural Steel

- Rectangular and Square HSS: ASTM A 500/A 500M, Grade B (Fy = 46 ksi).

- Round HSS: ASTM A500, Grade B (Fy = 42 ksi).
- Channels, Angles, M, S-Shapes: ASTM A 36/A 36M (Fy=36 ksi).
- Plate: ASTM A 36/A 36M (Fy=36 ksi).
- Wide Flange Shapes: ASTM A992 (Fy = 50 ksi)

6. Structural Special Inspections

1. In accordance with Section 1704 of the international building code, and all applicable state and local requirements, an independent approved agency shall make periodic and/or continuous inspections of the construction progress in accordance with the following requirements:

Steel Construction	Section 1704.3, Table 1704.3
Concrete Construction	Section 1704.4, Table 1704.4

CHAPTER 7

CRITICAL PATH METHOD (CPM)

1. PROJECT MASTER SCHEDULE

.1 Refer to Appendix A for the Project Master Schedule, which shows the projected overall schedule from the Design Phase Services Notice-To-Proceed (NTP), to the final turnover after completion of the design.

.2 The schedule is not final and will be expanded and updated throughout the design and construction of this project.

2. PHASING

.1 This schedule is presented without taking into account equipment purchasing and the completion of construction of adjacent Building 103.

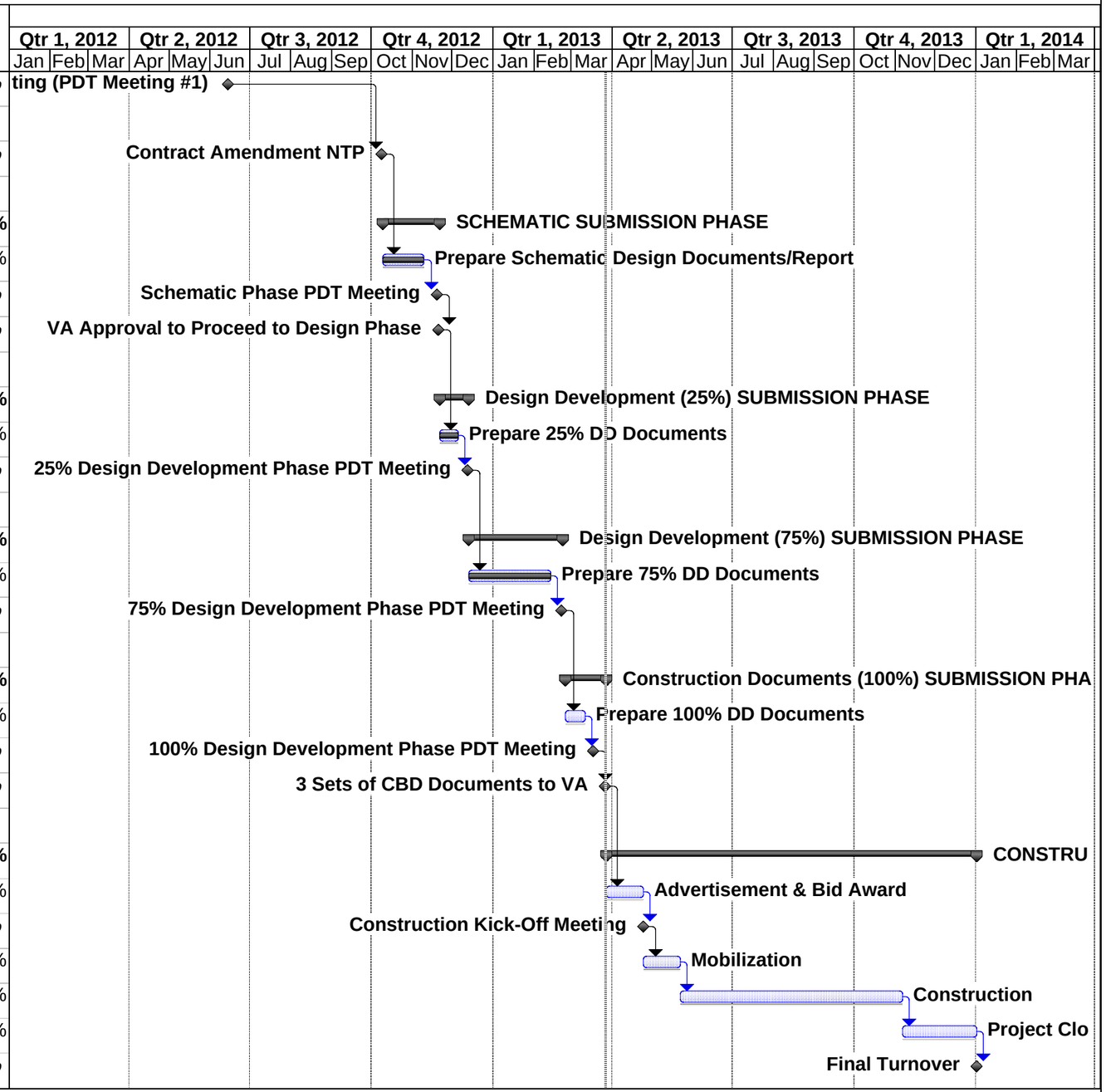
APPENDIX A

CRITICAL PATH METHOD (CPM) PROJECT SCHEDULE

Miller-Remick Corp.

CT/Radiology Room for Emergency Department
VA Project # 595-11-126

ID	Task Name	Calendar Days from Kick-Off	Start	Finish	% Complete
1	***Kick-Off Meeting (PDT Meeting #1)***	***0 days***	***6/15/12***	***6/15/12***	***100%***
2					
3	***Contract Amendment NTP***	***117 days***	***10/9/12***	***10/9/12***	***100%***
4					
5	**SCHEMATIC SUBMISSION PHASE**	**160 days**	**10/10/12**	**11/21/12**	**100%**
6	Prepare Schematic Design Documents/Report	148 days	10/10/12	11/9/12	100%
7	***Schematic Phase PDT Meeting***	***159 days***	***11/20/12***	***11/20/12***	***100%***
8	***VA Approval to Proceed to Design Phase***	***160 days***	***11/21/12***	***11/21/12***	***100%***
9					
10	**Design Development (25%) SUBMISSION PHASE**	**182 days**	**11/22/12**	**12/13/12**	**100%**
11	Prepare 25% DD Documents	174 days	11/22/12	12/5/12	100%
12	***25% Design Development Phase PDT Meeting***	***182 days***	***12/13/12***	***12/13/12***	***100%***
13					
14	**Design Development (75%) SUBMISSION PHASE**	**253 days**	**12/14/12**	**2/22/13**	**98%**
15	Prepare 75% DD Documents	244 days	12/14/12	2/13/13	100%
16	***75% Design Development Phase PDT Meeting***	***253 days***	***2/22/13***	***2/22/13***	***0%***
17					
18	**Construction Documents (100%) SUBMISSION PHA**	**286 days**	**2/25/13**	**3/27/13**	**0%**
19	Prepare 100% DD Documents	270 days	2/25/13	3/11/13	0%
20	***100% Design Development Phase PDT Meeting***	***277 days***	***3/18/13***	***3/18/13***	***0%***
21	***3 Sets of CBD Documents to VA***	***286 days***	***3/27/13***	***3/27/13***	***0%***
22					
23	**CONSTRUCTION PHASE**	**566 days**	**3/28/13**	**1/1/14**	**0%**
24	Advertisement & Bid Award	314 days	3/28/13	4/24/13	0%
25	***Construction Kick-Off Meeting***	***314 days***	***4/24/13***	***4/24/13***	***0%***
26	Mobilization	342 days	4/25/13	5/22/13	0%
27	Construction	510 days	5/23/13	11/6/13	0%
28	Project Close-Out	566 days	11/7/13	1/1/14	0%
29	***Final Turnover***	***566 days***	***1/1/14***	***1/1/14***	***0%***

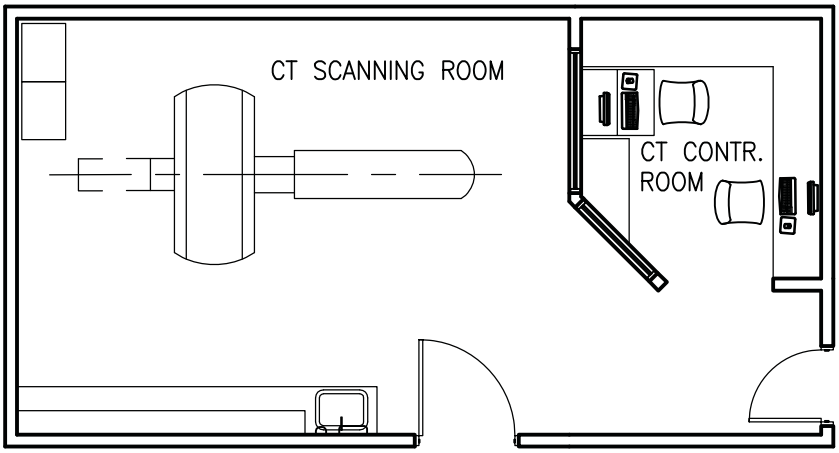


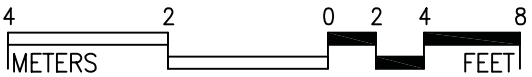
APPENDIX B

ARCHITECTURAL

CT Suite

Key Plan



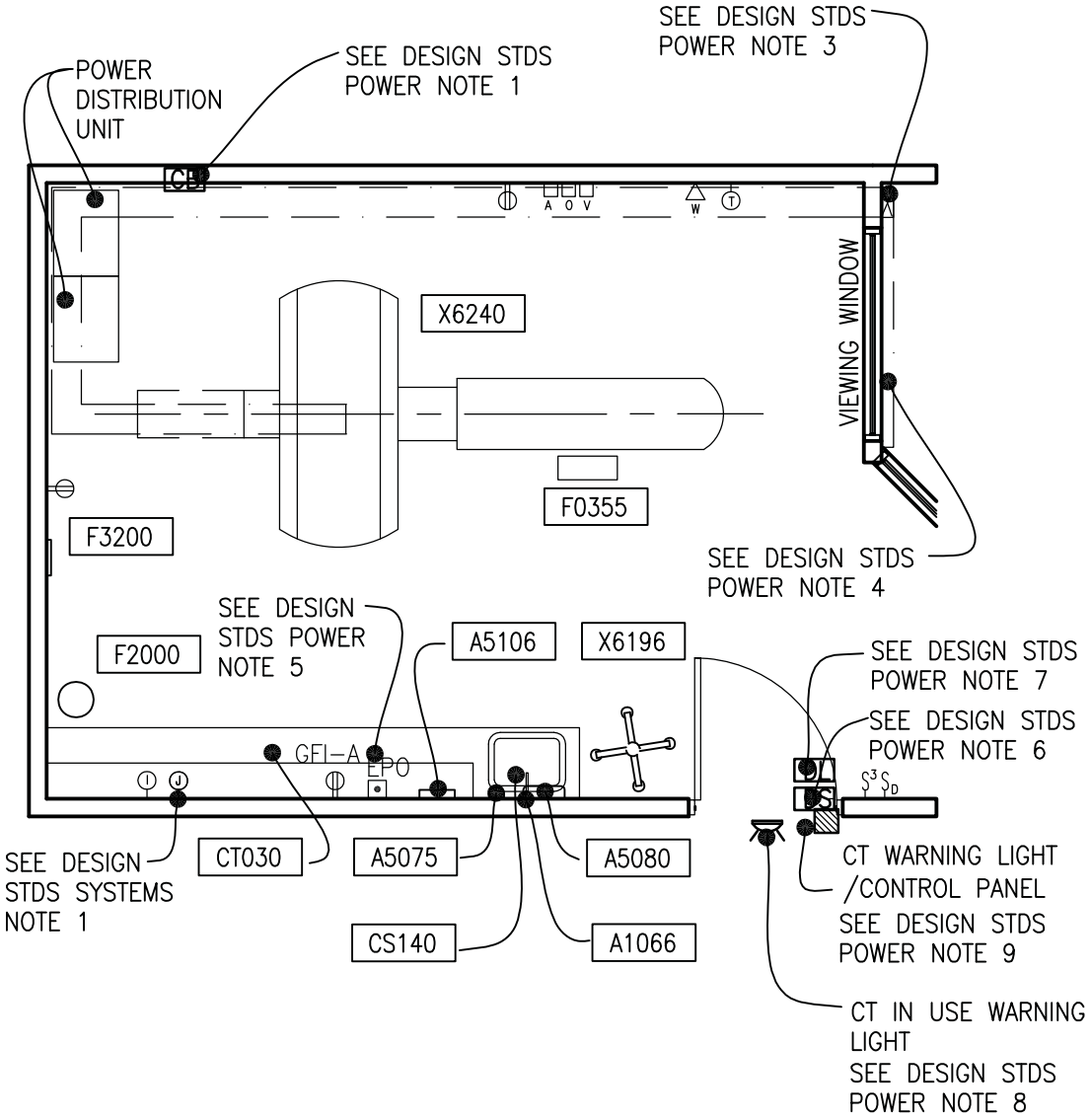


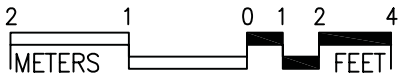
1/8" = 1'–0"

Guide plates are graphical representations of selected room types, illustrating the integration of space, components, systems, and equipment. They provide typical configurations and general technical guidance, and are not intended to be project specific. Specific infrastructure design requirements are contained in VA Design Manuals and Space Planning Criteria located in the VA Technical Information Library.

CT Scanning Room (XCTS1) 430 NSF

Floor Plan 39.9 NSM





3/16" = 1'–0"

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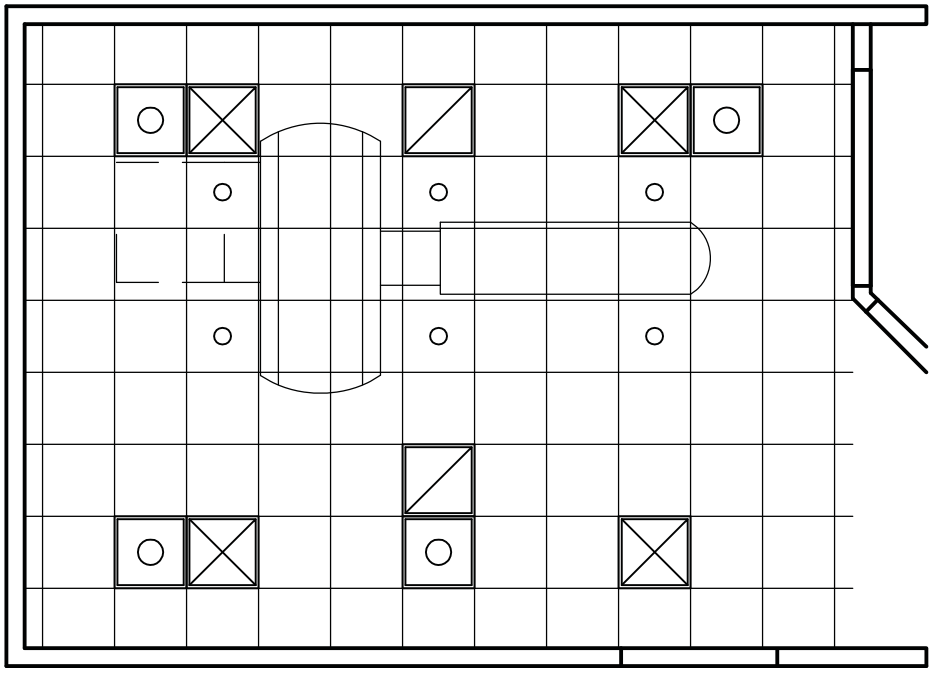
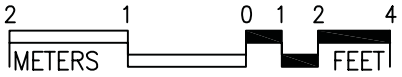
CT Scanning Room (XCTS1) 430 NSF

Reflected Ceiling Plan 39.9 NSM





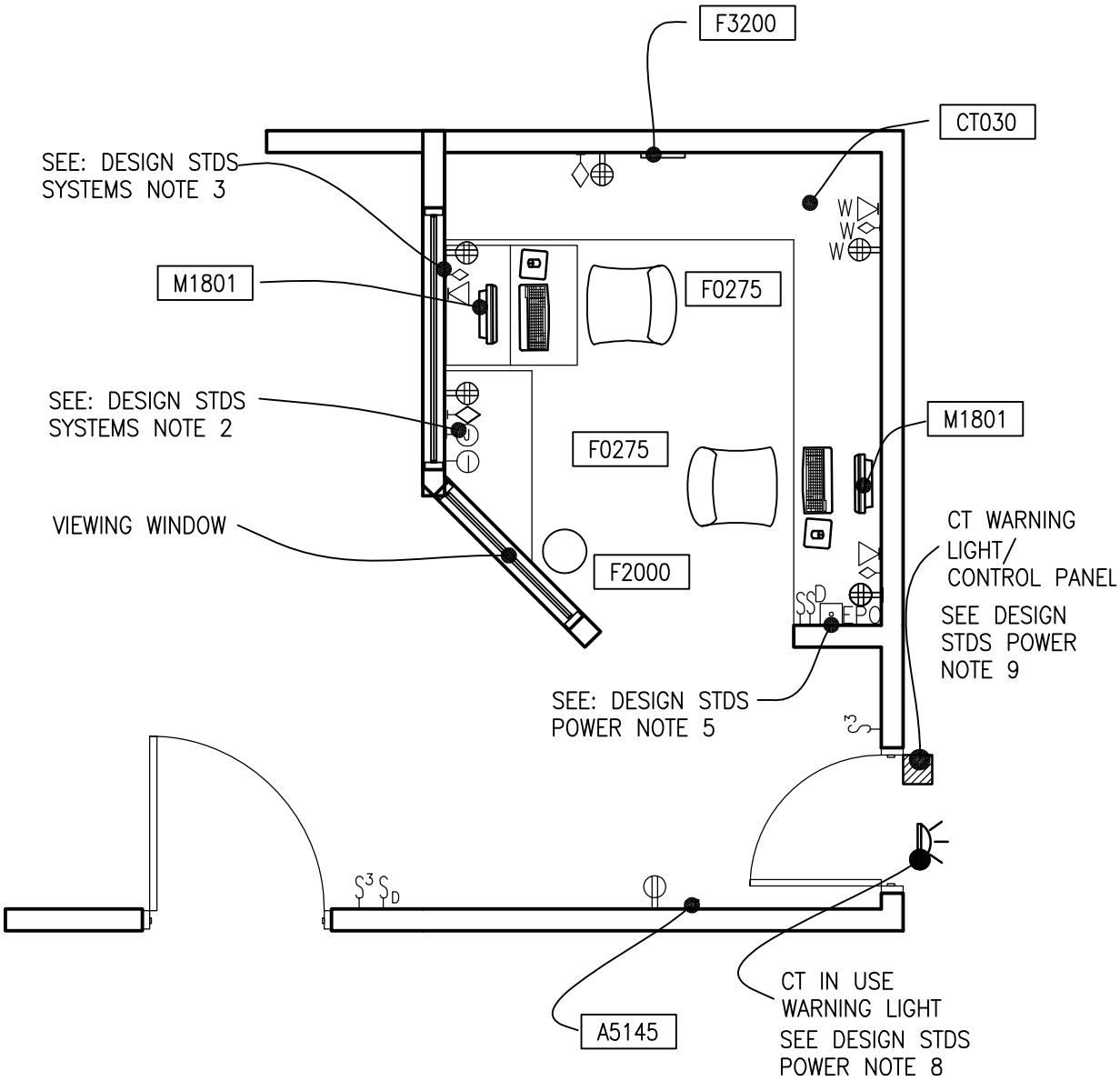
3/16" = 1'–0"

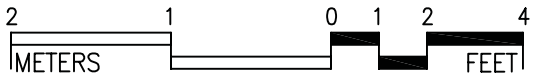
The locations and quantities of the air outlets and inlets are tentative and may not represent the optimum design solution(s) envisioned by the designer, who shall study the layout, calculate air volumes, and may alter the arrangement shown in the reflected ceiling plan, as required, to produce a project–specific air distribution system design.

Guide plates are graphical representations of selected room types, illustrating the integration of space, components, systems, and equipment. They provide typical configurations and general technical guidance, and are not intended to be project specific. Specific infrastructure design requirements are contained in VA Design Manuals and Space Planning Criteria located in the VA Technical Information Library.

CT Control Room (XCTC1) 140 NSF

Floor Plan 13.0 NSM





1/4" = 1'–0"

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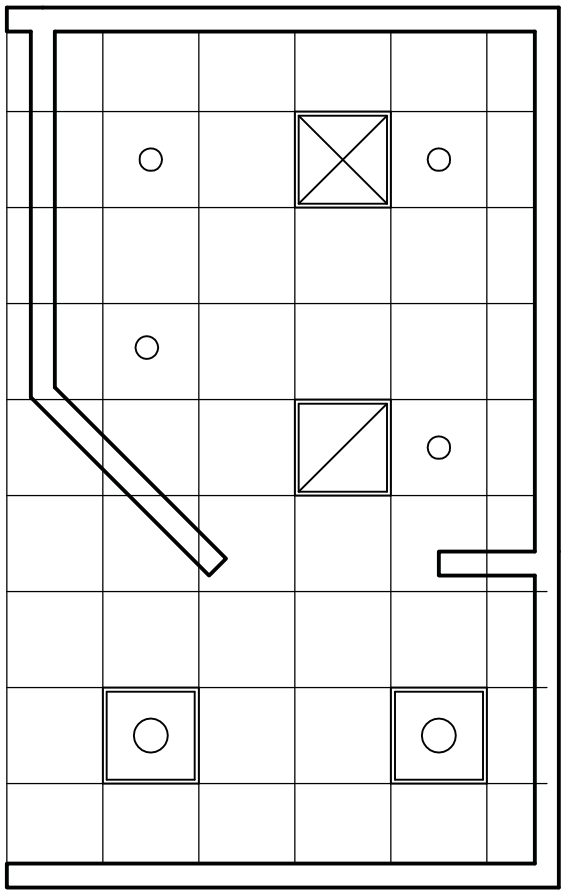
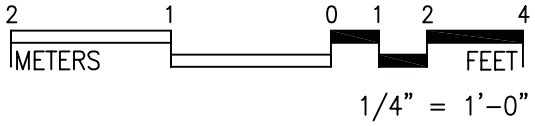
CT Control Room (XCTC1) 140 NSF

Reflected Ceiling Plan 13.0 NSM





1/4" = 1'–0"

The locations and quantities of the air outlets and inlets are tentative and may not represent the optimum design solution(s) envisioned by the designer, who shall study the layout, calculate air volumes, and may alter the arrangement shown in the reflected ceiling plan, as required, to produce a project–specific air distribution system design.

Guide plates are graphical representations of selected room types, illustrating the integration of space, components, systems, and equipment. They provide typical configurations and general technical guidance, and are not intended to be project specific. Specific infrastructure design requirements are contained in VA Design Manuals and Space Planning Criteria located in the VA Technical Information Library.

CT SUITE (XCTS1 & XCTC1): Design Standards

ARCHITECTURAL

Ceiling:	Acoustical Tile Ceiling
Ceiling Height:	Coordinate with Equip. Manuf.
Wall Finish:	Paint
Wainscot:	--
Base:	Vinyl Base
Floor Finish:	Vinyl Composition Tile
Sound Protection:	--

Notes:

1. Provide a 4'-0" wide shielded door into the CT Scanning Room
2. Provide a shielded viewing window from CT Control Room to the CT Scanning Room.

LIGHTING

CT Scanning Room

General: Fluorescent lights will provide higher illumination level up to 50 FC during patient transfer on and from the table, equipment setting, room cleaning, and equipment maintenance.

Special: Incandescent luminaires controlled by dimmer will provide lower illumination levels down to 5 FC during scanning. Luminaires shall be located to avoid direct glare for patient comfort.

CT Control Room

General: Fluorescent lights will provide higher illumination level up to 30 FC for room cleaning, and equipment maintenance.

Special: Incandescent luminaires controlled by dimmer will provide lower illumination levels down to 5 FC during scanning for monitor viewing.

Notes:

1. 2'x2' fluorescent recessed luminaire, acrylic prismatic lens, with (2) FB031T8-U lamps, 4100 K, CRI=85 (Minimum)
2. 8-inch dia., recessed incandescent downlight, with recessed Fresnel lens, and 150W/A21 inc. horizontally mounted lamp.
3. 2'x4' fluorescent recessed luminaire, acrylic prismatic lens, with (3) F32T8 lamps, 3500 K.
4. CT Scanning Room fluorescent lighting controlled by 3-way switches located at entrance door and in control area
5. CT Scanning Room incandescent downlighting controlled by 3-way dimmers located in CT room and control area.
6. CT Control Room incandescent downlighting controlled by separate dimmer located in control area.

POWER

The electrical power as shown is to be used as a guide only. Equipment locations, dimensions and wiring requirements should be per the CT system suppliers' equipment drawings. Electrical trades should provide necessary conduits, openings, bushings, nipples, flexible conduits, surface, recessed, wall mounted and floor raceways, etc., as required at the various junction boxes, duct and conduit terminations to allow proper connections of the CT equipment and related accessories

Emergency:
Emergency power for CT equipment, controls, and selected receptacles as determined by the Hospital

Notes:

1. 480V, 3P-150A circuit breaker, with adjustable trip, shunt trip, flush mounted. Run empty 50 mm (2"C) from circuit breaker to the floor duct.
2. 300 mm x 90 mm (12" W x 3-1/2" D) multi-compartment flush floor duct with screw–on cover. Connect to vertical wall duct.
3. 250 mm x 90 mm (10" W x 3-1/2" D) multi-compartment surface vertical wall duct with screw–on cover. Connect to CT floor duct and horizontal wall duct.

4. 120 mm x 90 mm (4-3/4" W x 3-1/2" D) multi-compartment surface wall duct with screw–on cover. Connect to vertical wall duct.
5. Emergency Power Off pushbutton station. Refer to specific radiology equipment requirements for EPO. Connect to shunt trip at main disconnect.
6. Door switch with NO/NC contacts. Connect to CT system control circuit. CT should shut-off upon opening of the entrance door.
7. Magnetic door interlock with CT controller to prevent interruption of scanning procedure (optional).
8. Warning light with wording "CT IN USE, DO NOT ENTER". Provide interface with CT controller via interface relay.
9. CT warning light interface relay with low voltage power supply to match CT equipment requirements.

COMMUNICATION/SPECIAL SYSTEMS

ADP:	Yes
Data:	Yes
Telephone:	Yes
Intercom:	Yes
Nurse Call:	--
Public Address:	--
Radio/Entertainment:	--
MATV:	--
CCTV:	Yes, note 1 & 2.
MID:	--
Security/Duress:	--
VTEL:	--
VA Satellite TV:	--

Notes:

1. Junction box for CCTV camera with conduit to Control area.
2. Junction box for CCTV monitor.
3. PACS:two 4-port telecommunication outlets per PACS station

HEATING, VENTILATING AND AIR CONDITIONING

Inside Design Conditions: 70℉ - 75℉ (21℃ - 24°)
30% to 60% Relative humidity
Minimum Air Changes per hour: - Supply Air
6 for CT Scanning Room
6 for CT Control Room
100% Exhaust: No
100% Outside air No
Room Air Balance: Positive for all rooms
Dedicated Exhaust System: No
Occupancy: 4 for CT Scanning Room
2 for CT Control Room
AC Load-(Equipment): 17,000 Btuh – 22,000BTUH (5,000W – 6,500 W) for CT Scanning Room.
4,000 Btuh – 8,500 Btuh (1,200W-2,500 W) for CT Control Room.

AC Load-Lighting: 2.0 W/SF (21 W/M^2) in CT Scanning Room
1.5W/SF (17 W/M^2) in CT Control Room.

Notes:

1. Verify cooling loads and other specific requirements with the equipment manufacturer on a specific project.
2. Certain CT Manufacturers require, and provide a dedicated CT Scanner chiller. This chiller should be installed per CT manufacturer's requirements.

PLUMBING AND MEDICAL GASES

Cold Water:	Yes
Hot Water:	Yes
Laboratory Air:	--
Laboratory Vacuum:	--
Sanitary Drain:	Yes
Reagent grade Water:	--
Medical Air:	Yes
Medical Vacuum:	Yes
Oxygen:	Yes

Notes:

1. Provide a floor drain to coordinate with chilled water equipment when required
2. Provide a backflow prevention device when a secondary emergency water connection to the chilled water equipment is required as a backup

CT SUITE (XCTS1 & XCTC1): Equipment Guide List

XCTS1 - CT Scanning Room					
JSN	NAME	QTY	ACQ / INS	DESCRIPTION	SPEC
A1010	Telecommunication Outlet	1	CC	Telecommunication outlet location.	27 31 00
A1012	Telephone, Wall Mounted, 1 Line	1	CC	Telephone, wall mounted, 1 line.	27 31 00
A1066	Mirror, Float Glass, With SS Frame	1	CC	A high quality 1/4" polished float glass mirror 36X18, framed in a one-piece, bright polished, stainless steel channel frame with 90° mitered corners. All edges of the mirror are protected by absorbing filler strips. Mirror has a galvanized steel back with integral horizontal hanging brackets and wall hanger for concealed mounting. For mounting above single wall mounted lavatories located in toilet areas, Doctors examination offices, etc. May also be used above double lavatories, either wall or countertop mounted, found in restroom areas.	10 28 00
A5075	Dispenser, Soap, Disposable	1	W	Disposable soap dispenser. One-handed dispensing operation. Designed to accommodate disposable soap cartridge and valve.	
A5080	Dispenser, Paper Towel, SS, Surface Mounted	1	CC	A surface mounted, satin finish stainless steel, single-fold, paper towel dispenser. Dispenser features: tumbler lock; front hinged at bottom; and refill indicator slot. Minimum capacity 400 single-fold paper towels. For general purpose use throughout the facility.	10 28 00
A5106	Waste Disposal Unit, Sharps w/Glove Dispenser	1	W	The unit is designed for the disposal of sharps and complies with OSHA guidelines for the handling of sharps. It shall house a 5 quart container and be capable of being mounted on a wall. It shall have a glove dispenser attached. The unit shall be secured by a locked enclosure.	

C03H0	Cabinet, U/C/B, 2 Half Drawers, 3 DR, 36x30x22	1	CC	Standing height under counter base cabinet with two half width drawers side-by-side above three full width drawers. Also referred to as a drawer cabinet. For general purpose use throughout the facility.	12 32 00
C03J0	Cabinet, U/C/B, 8 Half Drawers, 36x30x22	1	CC	Standing height under counter base cabinet with eight half width drawers of equal height. Also referred to as a drawer cabinet. For general purpose use throughout the facility.	12 32 00
C03P0	Cabinet, Sink, U/C/B, 2 Door, 30" W	1	CC	Standing height under counter base sink cabinet. 36" H x 30" W x 22" D with two solid hinged doors. Also referred to as a double-door sink cabinet. For general purpose use throughout the facility where a sink is to be used. Coordinate actual clear cabinet dimension with the actual outside dimension of sink that is specified to ensure that they are compatible.	12 32 00
CE030	Cabinet, W/H, 2 SH, 2 GDO, Sloping Top, 38x30x13	1	CC	Wall hung cabinet with two adjustable shelves, framed-glass hinged doors, and sloping top. Also referred to as a framed-glass hinged double door wall case. For general purpose use throughout the facility.	12 32 00
CS140	Sink, SS, Single Compartment, 10x14x16 ID	1	CC	Single compartment stainless steel sink, drop-in, self-rimming, ledge-type, connected with a drain and provided with a mixing faucet. It shall also be provided with punched fixture holes on 4" center, integral back ledge to accommodate deck-mounted fixtures, brushed/polished interior and top surfaces, and sound deadened. Recommended for use in suspended or U/C/B sink cabinets having a high plastic laminate or Chemsurf laminate countertop/work surface. Coordinate actual outside sink dimensions with the actual clear dimension of cabinet specified to ensure that they are compatible. For general purpose use throughout the facility.	22 40 00

CT030	Countertop, High Pressure Laminate	AR	CC	High pressure laminate countertop (composition of wood particle core with plastic laminate surface) having a hard smooth surface finish, standard thickness of 1", and a 4" butt backsplash/curb. Also referred to as a work surface or work top. Available in a wide choice of colors, patterns, and depths. Used in general purpose areas requiring a basic work surface arrangement with limited heat resistance and poor chemical resistance. Pricing based upon a 24" depth.	12 36 00
F0355	Footstool, Straight	1	W	Step stool. Used to assist patients getting on and off exam or surgical tables. Fitted with electrically conductive rubber tips.	
F2000	Basket, Wastepaper, Round, Metal	1	W	Round wastepaper basket, approximately 18" high X 16" diameter. This metal unit is used to collect and temporarily store small quantities of paper refuse in patient rooms, administrative areas and nursing stations.	
F3200	Clock, Battery, 12" Diameter	1	W	Clock, 12" diameter. Round surface, easy to read numbers with sweep second hand. Wall mounted unit for use when impractical to install a fully synchronized clock system. Battery operated, (batteries not included).	
M0750	Flowmeter, Air, Connect w/50 PSI Supply	1	W	Air flowmeter. Unit has a stainless steel needle valve with clear flowtube for connection to 50 PSI air outlet from central pipeline system. Requires the appropriate adapter for connection to the wall outlet and fitting to connect to tubing. Database prices reflect fittings with an attached DISS power outlet. Other outlet and adapter configurations are available.	22 63 00
M0755	Flowmeter, Oxygen, Low Flow	1	W	Oxygen flowmeter. Consists of a clear crystal flowtube calibrated to 3.5 or 8 LPM depending on manufacturer. For oxygen regulation in hospital settings. Database pricing includes DISS fitting and DISS power outlet and wall adapter. Other fitting and adapter configurations are available.	22 63 00

M0765	Regulator, Vacuum	1	W	An air/oxygen mixer is designed to accurately control a pressurized gas mixing with an oxygen concentration. Unit contains audible alarms to warn of supply failure, an auxiliary outlet and a oxygen concentration control adjustment range from 21% to 100%. The unit can also be used to supply an accurate pre-mixed gas source to respiration or ventilator units. A specific application may require an additional air inlet filter/water trap.	22 62 00
X3150	Rack, Apron/Gloves, Wall Mounted	1	CC	Apron and gloves rack. This is a wall unit which holds aprons and gloves. The body is heavy gauge steel finish in gray or green baked enamel, glove and apron holding arms are aluminum. The unit's convenient on wall storage will prolong the useful life of your protection aprons by helping prevent damage to internal components.	
X6196	Injector, CT	1	CF	This unit is a specialized radiographic system that provides sharp, well-defined visual images of the vascular anatomy. The injector introduces a vision radiopaque fluid (contrast medium) into an artery or vein through a small catheter, making vessels contrast with their more radiolucent surrounding. The unit incorporates an electromechanical or pneumatically driven syringe to deliver the contrast medium. The syringe assemblies consist of an electric motor connected to a jackscrew that moves the syringe piston into or out of the syringe barrel. The unit is used in hospitals with radiographic procedures. The unit can be ceiling, wall, or remote stand mounted.	

X6240	Radiographic Unit, Computerized Tomography (CT)	1	CF	The CT Scanner System is an noninvasive radiographic technique that involves the reconstruction of a tomographic plane of the body (four slices per revolution) from a large number of collected x-ray absorption measurements taken during a scan around the body's periphery. The CT System shall be a single gantry, whole body scanning system appropriate to support tertiary care facilities with an annual projected workload of less than 5,500 separate studies. System includes DICOM 3.0 or latest version software protocol. System to be procured with turnkey installation.	

XCTC1 - Control Room

JSN	NAME	QTY	ACQ / INS	DESCRIPTION	SPEC
A1010	Telecommunication Outlet	1	CC	Telecommunication outlet location.	27 31 00
A1012	Telephone, Wall Mounted, 1 Line	1	CC	Telephone, wall mounted, 1 line.	27 31 00
A5145	Hook, Garment, Double, SS, Surface Mounted	1	CC	A surface mounted, satin finish stainless steel, double garment hook. Equipped with a concealed mounting bracket that is secured to a concealed wall plate. For general purpose use throughout the facility to hang various items of apparel.	10 28 00
C0044	Frame, Apron, 1 Drawer, 4x30x22	1	CC	Apron frame with one standard drawer. Also referred to as a drawer frame or table frame. Used for a knee space as a combination frame and drawer to support a top between base cabinets or a base cabinet and a wall.	12 32 00
C0045	Frame, Apron, 1 Drawer, 4x36x22	2	CC	Apron frame with one standard drawer. Also referred to as a drawer frame or table frame. Used for a knee space as a combination frame and drawer to support a top between base cabinets or a base cabinet and a wall.	12 32 00
C06M0	Cabinet, U/C/B, 1 PBD, 2 DR, 1 File DR, 30x18x22	3	CC	Cabinet, U/C/B, 1 PBD, 2 DR, 1 File DR, 30x18x22	12 32 00

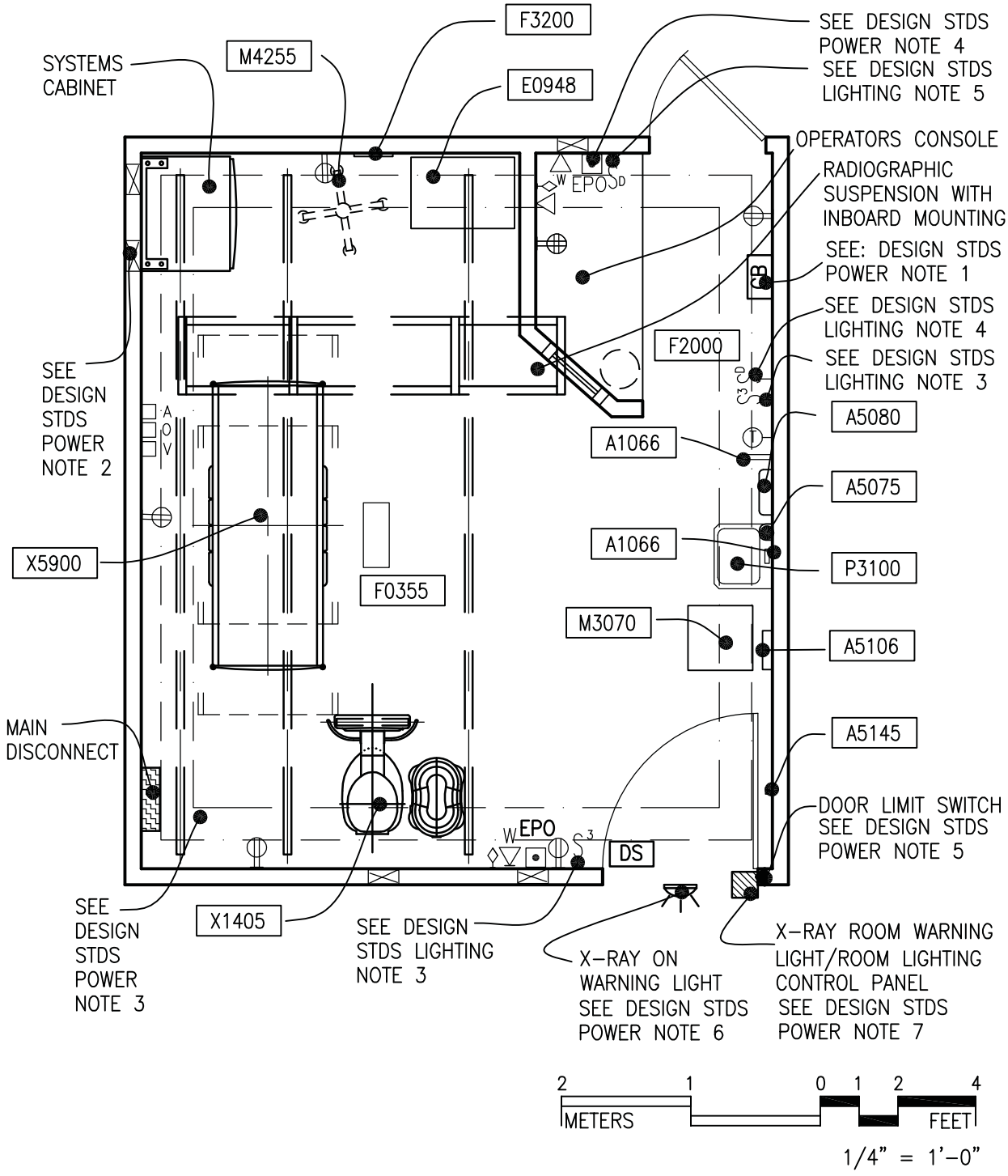
CT030	Countertop, High Pressure Laminate	AR	CC	High pressure laminate countertop (composition of wood particle core with plastic laminate surface) having a hard smooth surface finish, standard thickness of 1", and a 4" butt backsplash/curb. Also referred to as a work surface or work top. Available in a wide choice of colors, patterns, and depths. Used in general purpose areas requiring a basic work surface arrangement with limited heat resistance and poor chemical resistance. Pricing based upon a 24" depth.	12 36 00
F0275	Chair, Swivel, High Back	2	W	Highback contemporary swivel chair, 41" high X 23" wide X 23" deep with five (5) caster swivel base and arms. Chair may be used at desks or in conference rooms. Back and seat are foam padded and upholstered with either woven textile fabric or vinyl.	
F2000	Basket, Wastepaper, Round, Metal	1	W	Round wastepaper basket, approximately 18" high X 16" diameter. This metal unit is used to collect and temporarily store small quantities of paper refuse in patient rooms, administrative areas and nursing stations.	
F3050	Whiteboard, Dry Erase	1	CC	Whiteboard unit, approximately 36" H x 48" W consisting of a white porcelain enamel writing surface with an attached chalk tray. Magnetic surface available. Image can be easily removed with a standard chalkboard eraser. For use with water color pens. Unit is ready to hang.	
F3200	Clock, Battery, 12" Diameter	1	W	Clock, 12" diameter. Round surface, easy to read numbers with sweep second hand. Wall mounted unit for use when impractical to install a fully synchronized clock system. Battery operated, (batteries not included).	

M1801	Computer, Microprocessing, w/Flat Panel Monitor	1	W	Desk top microprocessing computer. The unit shall consist of a central processing mini tower, flat panel monitor, keyboard, mouse and speakers. The system shall have the following minimum characteristics: a 2.8 GHz Pentium processor; 512 MB memory; 80GB hard drive; 32/48x CD-ROMDVD combo; a 3.5" floppy drive; 1.44MB network interface card; video 32 MB NVIDIA; a 15 inch flat panel color monitor. The computer is used throughout the facility to input, manipulate and retrieve information.	
M1840	Printer/Copier/Fax Combination	1	W	Multifunctional printer, fax, scanner and copier (PFC) all-in-one machine.	
X1425	Imager, Laser (1024 X 1024) (Din/PACS)	1	CF	Laser imager. An infrared laser beam is scanned across the film by a precision rotating polygon, while correcting optic focus and controlling the beam's intensity. The characteristics and components include an automatic film handling system and uses 10" X 14" IR film. It can be interfaced to additional imaging modalities with optional interface kit. For use with digital output imaging modalities.	
X4112	Console, PACS, Remote View, 1k X 1k, 2 Monitors	1	CF	Two monitor remote viewing station for picture archiving and retrieval (PACS) system. This station is for use by providers inside or outside of radiology to review images. Station includes local image storage, image manipulation, and simultaneous display of multiple images on two 1024 x 1024 image display CRT's. Images are stored on a resident hard disk and roll off the disk as more recent images are sent to the station. Provider may request images from the PACS. Unit must be connected to the PACS by LAN for image and result receipt. This station is for use in areas like radiologist's offices and the E.R.. where a more comprehensive system is required. Console must be DICOM compliant. Input may be by keyboard, mouse, trackball or voice activated commands.	

X6240	**Components of Parent Item:** Radiographic Unit, Computerized Tomography (CT) may include: Workstation with LCD Monitors, Injector Conrtol and electronic station, and operator console and computer	1	CF	The CT Scanner System is an noninvasive radiographic technique that involves the reconstruction of a tomographic plane of the body (four slices per revolution) from a large number of collected x-ray absorption measurements taken during a scan around the body's periphery. The CT System shall be a single gantry, whole body scanning system appropriate to support tertiary care facilities with an annual projected workload of less than 5,500 separate studies. System includes DICOM 3.0 or latest version software protocol. System to be procured with turnkey installation.	

General Purpose Radiology Room (XDR01) 300 NSF

Floor Plan 27.9 NSM



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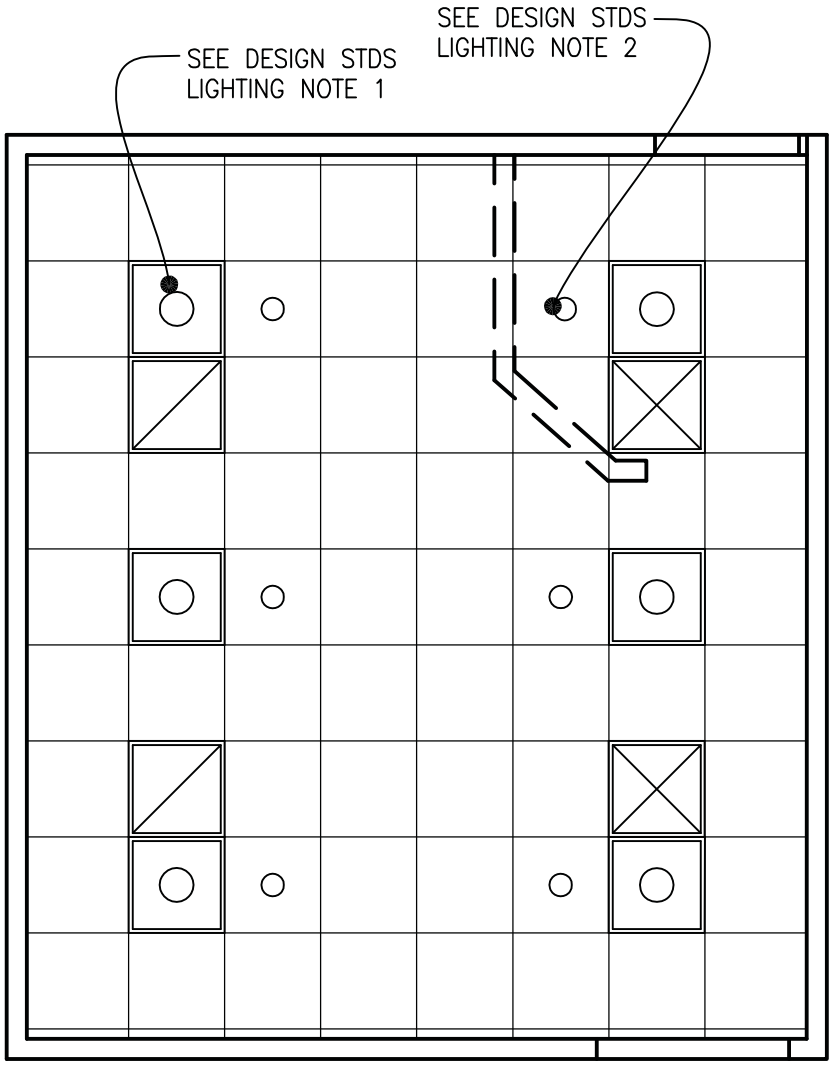
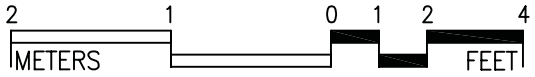
General Purpose Radiology Room (XDR01) 300 NSF

Reflected Ceiling Plan 27.9 NSM





1/4" = 1'–0"

The locations and quantities of the air outlets and inlets are tentative and may not represent the optimum design solution(s) envisioned by the designer, who shall study the layout, calculate air volumes, and may alter the arrangement shown in the reflected ceiling plan, as required, to produce a project–specific air distribution system design.

Guide plates are graphical representations of selected room types, illustrating the integration of space, components, systems, and equipment. They provide typical configurations and general technical guidance, and are not intended to be project specific. Specific infrastructure design requirements are contained in VA Design Manuals and Space Planning Criteria located in the VA Technical Information Library.

GENERAL PURPOSE RADIOGRAPHIC ROOM (XDR01): Design Standards

ARCHITECTURAL

Ceiling:	Acoustical Tile Ceiling
Ceiling Height:	Coordinate with Equipment Manufacturer
Wall Finish:	Paint
Wainscot:	--
Base:	Vinyl
Floor Finish:	Vinyl Composition Tile
Sound Protection:	--

Notes:

1. Provide a 4'-0" wide shielded door into the General Purpose Radiographic Room.
2. Provide a shielded viewing window from the Control Area to the General Purpose Radiographic Room.

LIGHTING

General: Fluorescent lights will provide higher illumination level up to 50 FC during patient transfer on and from the table, equipment setting, room cleaning, and equipment maintenance.

Special: Incandescent luminaires controlled by dimmer will provide lower illumination levels down to 5 FC during X-ray tube aiming and scanning. Warmer light color will enhance skin appearance and increase patient comfort.

Luminaires shall be located to avoid conflict with radiographic equipment ceiling tracks.

Notes:

1. 2'x2' fluorescent recessed luminaire, acrylic prismatic lens, with (2) FB031T8-U lamps, 4100 K, CRI=85 (minimum)
2. 8-inch diameter., recessed incandescent downlight, with recessed Fresnel lens, and 150W/A21 inc. horizontally mounted lamp.
3. Fluorescent lighting controlled by 3-way switches located at entrance door and in control area
4. Incandescent down lighting in X-ray room controlled by dimmer located in X-ray room.
5. Incandescent down lighting in control area controlled by separate dimmer located in control area.

POWER

The electrical power as shown is to be used as a guide only. Equipment locations, dimensions and wiring requirements should be per the x-ray system suppliers' equipment drawings. Electrical trades should provide necessary conduits, openings, bushings, nipples, flexible conduits, surface, recessed, wall mounted and floor raceways, etc., as required at the various junction boxes, duct and conduit terminations to allow proper connections of the x-ray equipment and related accessories.

Emergency:
Emergency power for x-ray equipment, controls, and selected receptacles as determined by the Hospital.

Notes:

1. 480V, 3P-150A circuit breaker, with adjustable trip, shunt trip, flush mounted. Run empty 50 mm (2"C) from circuit breaker to x-ray duct above finished ceiling.
2. 250 mm x 140 mm (10" W x 5-1/2" D) flush vertical wall duct with 300 mm (12") wide screw–on cover. Connect to x-ray duct above finished ceiling and terminate at finished floor.
3. 250 mm x 140 mm (10" W x 5-1/2" D) x-ray duct above finished ceiling with 250 mm (10") wide screw–on cover. Connect to vertical wall duct.
4. Emergency Power Off pushbutton station. Refer to specific radiology equipment requirements for EPO. Connect to shunt trip at main disconnect.
5. Door switch with NO/NC contacts. Connect to x-ray machine control circuit. X-ray machine should shut-off upon opening of the entrance door.

6. Warning light with wording "X-RAY ON DO NOT ENTER". Provide power, interface with x-ray machine via interface relay.
7. X-ray warning light interface relay with low voltage power supply to match x-ray equipment requirements.

COMMUNICATION/SPECIAL SYSTEMS

ADP:	Yes
Data:	Yes
Telephone:	Yes
Intercom:	--
Nurse Call:	--
Public Address:	--
Radio/Entertainment:	--
MATV:	--
CCTV:	--
MID:	--
Security/Duress:	--
VTEL:	--
VA Satellite TV:	--

Notes:
PACS: two 4-port telecommunication outlets per PACS station

HEATING, VENTILATING AND AIR CONDITIONING

Inside Design Conditions:	70°F - 75°F (21°C - 24°) 30% to 60% Relative humidity
Minimum Air Changes per hour: - Supply Air	6
100% Exhaust:	No-See Note 2
100% Outside air	No-See Note 2
Room Air Balance:	Positive
Dedicated Exhaust System:	No
Occupancy:	4 people
AC Load-Equipment:	5,000 Btuh – 13,500 Btuh (1,500W- 4000 W)
AC Load-Lighting:	1.6 W/SF (17 W/M^2)

Notes:

1. Verify cooling loads and other specific requirements with the equipment manufacturer on a specific project.
2. Refer also to general requirements for mycobacterium tuberculosis in Radiology Department and HVAC Design Manual "TB Criteria".

PLUMBING AND MEDICAL GASES

Cold Water:	Yes
Hot Water:	Yes
Laboratory Air:	--
Laboratory Vacuum:	--
Sanitary Drain:	Yes
Reagent grade Water:	Possible
Medical Air:	Yes
Medical Vacuum:	Yes
Oxygen:	Yes

Notes:

GENERAL PURPOSE RADIOGRAPHIC ROOM (XDR01): Equipment Guide List

JSN	NAME	QTY	ACQ / INS	DESCRIPTION	SPEC
A1010	Telecommunication Outlet	1	CC	Telecommunication outlet location.	27 31 00
A1012	Telephone, Wall Mounted, 1 Line	1	CC	Telephone, wall mounted, 1 line.	27 31 00
A1066	Mirror, Float Glass, With SS Frame	1	CC	A high quality 1/4" polished float glass mirror 36X18, framed in a one-piece, bright polished, stainless steel channel frame with 90° mitered corners. All edges of the mirror are protected by absorbing filler strips. Mirror has a galvanized steel back with integral horizontal hanging brackets and wall hanger for concealed mounting. For mounting above single wall mounted lavatories located in toilet areas, Doctors examination offices, etc. May also be used above double lavatories, either wall or countertop mounted, found in restroom areas.	10 28 00
A5075	Dispenser, Soap, Disposable	1	VV	Disposable soap dispenser. One-handed dispensing operation. Designed to accommodate disposable soap cartridge and valve.	10 28 00
A5080	Dispenser, Paper Towel, SS, Surface Mounted	1	CC	A surface mounted, satin finish stainless steel, single-fold, paper towel dispenser. Dispenser features: tumbler lock; front hinged at bottom; and refill indicator slot. Minimum capacity 400 single-fold paper towels. For general purpose use throughout the facility.	10 28 00
A5106	Waste Disposal Unit, Sharps w/Glove Dispenser	1	VV	The unit is designed for the disposal of sharps and complies with OSHA guidelines for the handling of sharps. It shall house a 5 quart container and be capable of being mounted on a wall. It shall have a glove dispenser attached. The unit shall be secured by a locked enclosure.	
A5145	Hook, Garment, Double, SS, Surface Mounted	1	CC	A surface mounted, satin finish stainless steel, double garment hook. Equipped with a concealed mounting bracket that is secured to a concealed wall plate. For general purpose use throughout the facility to hang various items of apparel.	10 28 00

F0205	Chair, Side With Arms	1	VV	Upholstered side chair, 32" high X 21" wide X 23" deep with arms, padded seats and padded backs. Seat height is a minimum of 17". Available with or without sled base.	
F0340	Stool, Self Adjusting	1	VV	Self adjusting stool. Consists of a foam padded upholstered seat with attached foot rest for added comfort. Mounted on swivel casters. Designed for doctor's use during examinations.	
F0355	Footstool, Straight	1	VV	Step stool. Used to assist patients getting on and off exam or surgical tables. Fitted with electrically conductive rubber tips.	
F3200	Clock, Battery, 12" Diameter	1	VV	Clock, 12" diameter. Round surface, easy to read numbers with sweep second hand. Wall mounted unit for use when impractical to install a fully synchronized clock system. Battery operated, (batteries not included).	
E0948	Cart, General Storage, Mobile, 42"H x 32"W x 22"D	1	VV	THIS TYPICAL INCLUDES: 1 Cart Body, Style-A Narrow, w/Raised Edge Top 1 Accessory Rail, Side 2 Drawers, 3" H (76mm) 4 Drawers, 6" H (152mm) Drawer Organizer Bins	
F2000	Basket, Wastepaper, Round, Metal	1	VV	Round wastepaper basket, approximately 18" high X 16" diameter. This metal unit is used to collect and temporarily store small quantities of paper refuse in patient rooms, administrative areas and nursing stations.	
F3200	Clock, Battery, 12" Diameter	1	VV	Clock, 12" diameter. Round surface, easy to read numbers with sweep second hand. Wall mounted unit for use when impractical to install a fully synchronized clock system. Battery operated, (batteries not included).	
M3070	Hamper, Linen, Mobile, w/Lid	1	VV	Mobile linen hamper with hand or foot operated lid. Made of heavy tubular stainless steel with heavy gauge welded steel platform. Holds 25" hamper bags. Mounted on ball bearing casters. For linen transport in hospitals and clinics.	

M4255	Stand, IV, Adjustable	1	VV	Adjustable IV stand with 4-hook arrangement. Stand has stainless steel construction with heavy weight base. It adjusts from 66 inches to 100 inches and is mounted on conductive rubber, ball bearing, swivel casters. Stand is used for administering intravenous solutions.	
P3100	Lavatory, Vitreous China, Slab Type	1	CC	Wall mounted, slab type, vitreous china, lavatory (approximate bowl size 7"x15"x10") with: faucet holes on 4" centers; gooseneck spout; wrist blade handles; and grid strainer. It shall be suitable for use in clinics, offices, washrooms or patient care area.	22 40 00
X1405	Stand, Bucky, Vertical, Tilt, Automatic	1	CF? This is VC on Old VA codes	Vertical and tilting bucky stand. This unit is mounted to the floor and wall to provide a vibration-free mounting platform for the universal bucky. The grid line free radiographs are produced at exposure times as short as two milliseconds. Characteristics and components include aluminum interspaced grid with a 36 inch (914 mm) to 40 inch (1016 mm) focal range. The unit's cassette size sensing tray accommodates all cassette sizes between 5 and 17 inches. The unit tilts at angles of +90/-20 degrees from the vertical position. The unit is used in X-ray facilities for processing radiography images.	
X3150	Rack, Apron/Gloves, Wall Mounted	1	CC	Apron and gloves rack. This is a wall unit which holds aprons and gloves. The body is heavy gauge steel finish in gray or green baked enamel, glove and apron holding arms are aluminum. The unit's convenient on wall storage will prolong the useful life of your protection aprons by helping prevent damage to internal components.	
X5900 (need new digital number)	Radiographic Unit, 80 kW, NonTilt Table	1	CF? This is VC on Old VA codes	This system is specifically designed to perform radiographic examinations in the Radiology Department. This units characteristics and components include, 80kW micro-processor controlled X-ray generator, a non-tilting table with a floating table top and an adjustable bucky, a ceiling suspended 0.6/1.2 mm tube unit and vertical bucky stand.	

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www.keystonephysics.com

February 6, 2013

Kristin Seage, LEED AP
Project Coordinator
SPIEZLE GROUP, INC.
321 West State Street
Media, PA 19063

Re: Lead shielding recommendations for Lebanon VA Medical ED CT / X-ray Rooms

Dear Ms. Seage:

I'm writing in reference to the lead (Pb) shielding recommendations for the X-ray and CT unit installations in the proposed remodeling for the Lebanon VA Medical Center. I have reviewed the blueprints that you forwarded to me by email attachment, and make the following recommendations to comply with exposure limits outside these rooms. These recommendations are made using the methodology outlined in report #147 from the National Council on Radiation Protection and Measurements, "Structural Shielding Design for Medical Imaging Facilities".

Construction Notes

- Shared walls are noted only one time throughout this report.
- The total recommended Pb thickness reported for a wall can be achieved by installing half of the recommended shielded thickness on each side of the wall studs. For example, a wall requiring 1/8" of Pb can have 1/16" Pb on one side of the studs and 1/16" Pb on the other side of the studs for a total of 1/8" Pb.
- If needed, lead can be stacked to achieve the desired thickness. For example, a 1/8" Pb requirement can be achieved by stacking 2 sheets of 1/16" Pb on one side of the stud wall.
- Lead shielding in a wall should extend from the floor to a height of 7 feet.
- No shielding is required in either the ceiling or the floor for these x-ray installations.

Room Shielding Specifications

General Radiography Room

- The wall (Wall A) separating the X-ray room from the Electrical Room and Bed Storage requires 1/32" Pb shielding.
- The wall (Wall B) separating the X-ray room from the Corridor requires 1/16" Pb shielding. The double Entry Door (B_1) between the X-ray room and the Corridor, including the astragal, requires 1/16" Pb shielding.
- Wall segment (Wall B_2) defined as a four foot wide portion of (Wall B) that is centered behind the Upright Film column, requires an additional 1/16" of Pb shielding. The total shielding needed behind the upright Film Column is 1/8" of Pb shielding.
- The wall (Wall C) separating the X-ray room from the CT Control Area requires 1/16" Pb shielding.
- The wall (Wall D) separating the X-ray room from the Operator Control Area requires 1/16" Pb shielding. All windows in the Operator Control wall require lead glass or acrylic of 1/16" Pb equivalence (1.58 mm).
- The wall (Wall E) separating the X-ray room from the Corridor requires 1/16" Pb shielding. The double Entry Door (E_1) between the X-ray room and the Corridor, including the astragal, requires 1/16" Pb shielding. See *Appendix "A".*

CT Scan Room

- The wall (Wall A) separating the CT Scan room from the X-ray Control room requires 1/8" Pb shielding on both portions of the wall around the counter.
- The wall (Wall B) separating the CT Scan room from the Operator Control area requires 3/32" Pb shielding. All windows in the Operator Control wall require lead glass or acrylic of 3/32" Pb equivalence (~2.38 mm).
- The wall (Wall C) separating the CT Scan room from the Corridor requires 1/16" Pb shielding. The shielding should extend from the intersection with the partition at the conference/lunch , through the entry doors, to a point approximately 4 feet behind the termination of the operator control wall. The double Entry Door (C_1) between the CT Scan room and the Corridor, including the astragal, requires 1/16" Pb shielding.
- The wall (Wall D) separating the CT Scan room from the Conference/Lunch requires 3/32" Pb shielding.
- The wall (Wall E) separating the CT Scan room from the Corridor requires 1/8" Pb shielding. The double Entry Door (E_1) between the CT Scan room and the Corridor, including the astragal, requires 1/8" Pb shielding. See *Appendix "B".*

Please refer to the attached color-coded 'Shielding Diagrams' for a visual overview and clarification of the shielding recommendations for this project.

If you have any questions or need clarification, please contact me at 1-866-755-2756, extension #1.

Sincerely,

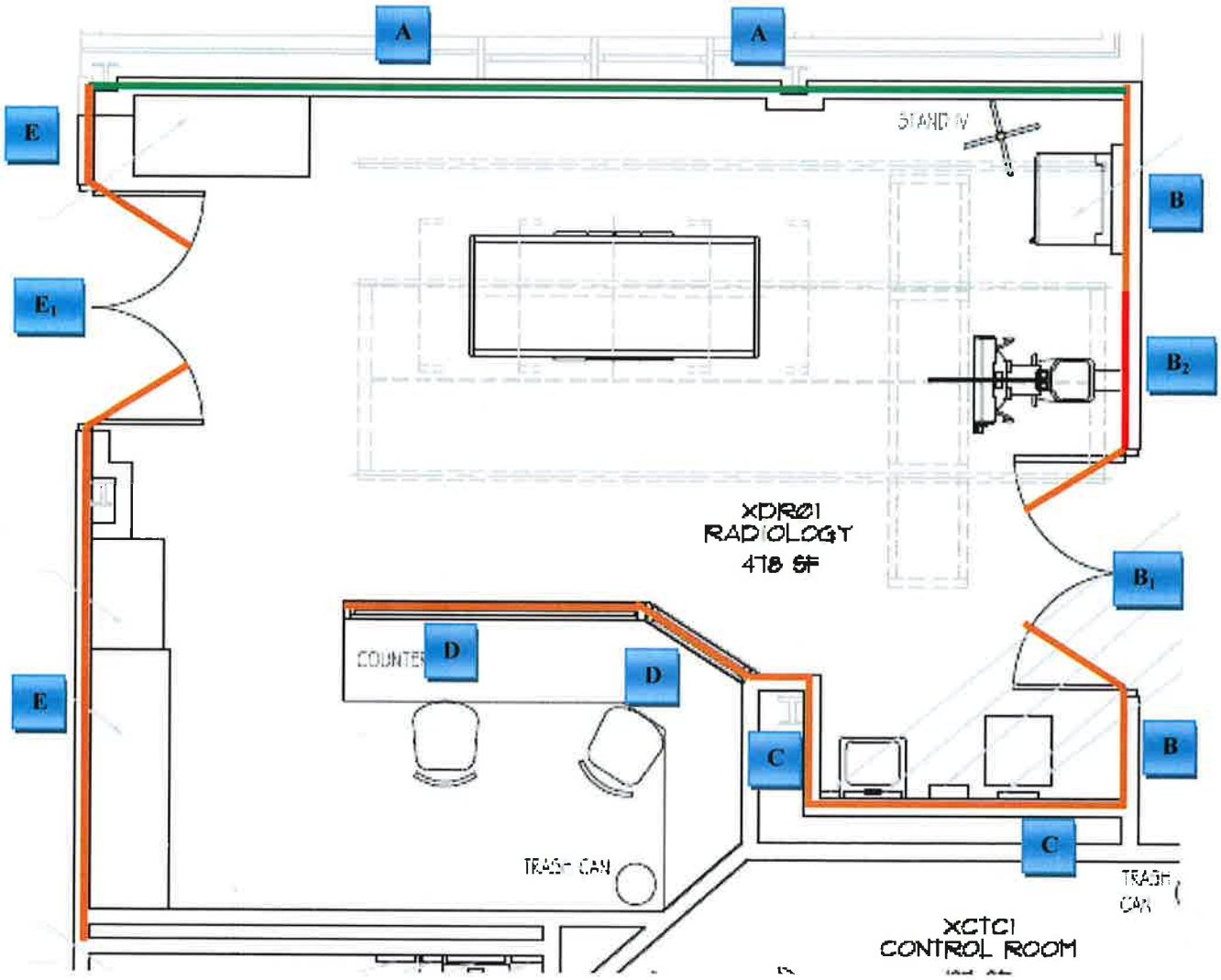
Jay M. Yoder, M.S., DABR
Certified Medical Radiation Health Physicist

Reference:

National Council on Radiation Protection and Measurements Report #147, "Structural Shielding Design for Medical Imaging Facilities". November 19, 2004.

APPENDIX – A

Shielding Diagram: General Radiographic Room

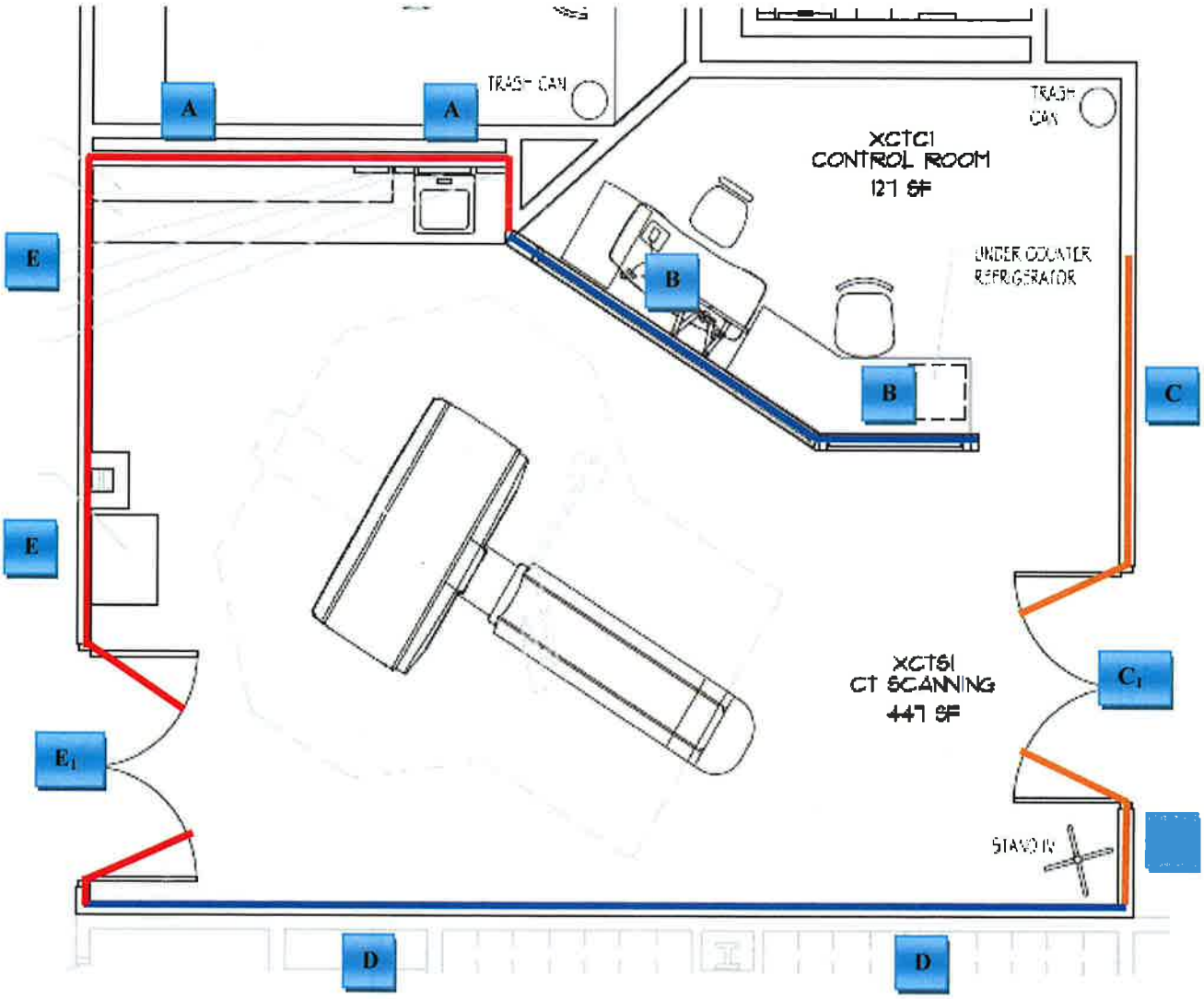


Shielding Legend

	1/32" Pb Shielding
	1/16" Pb Shielding
	1/8" Pb Shielding

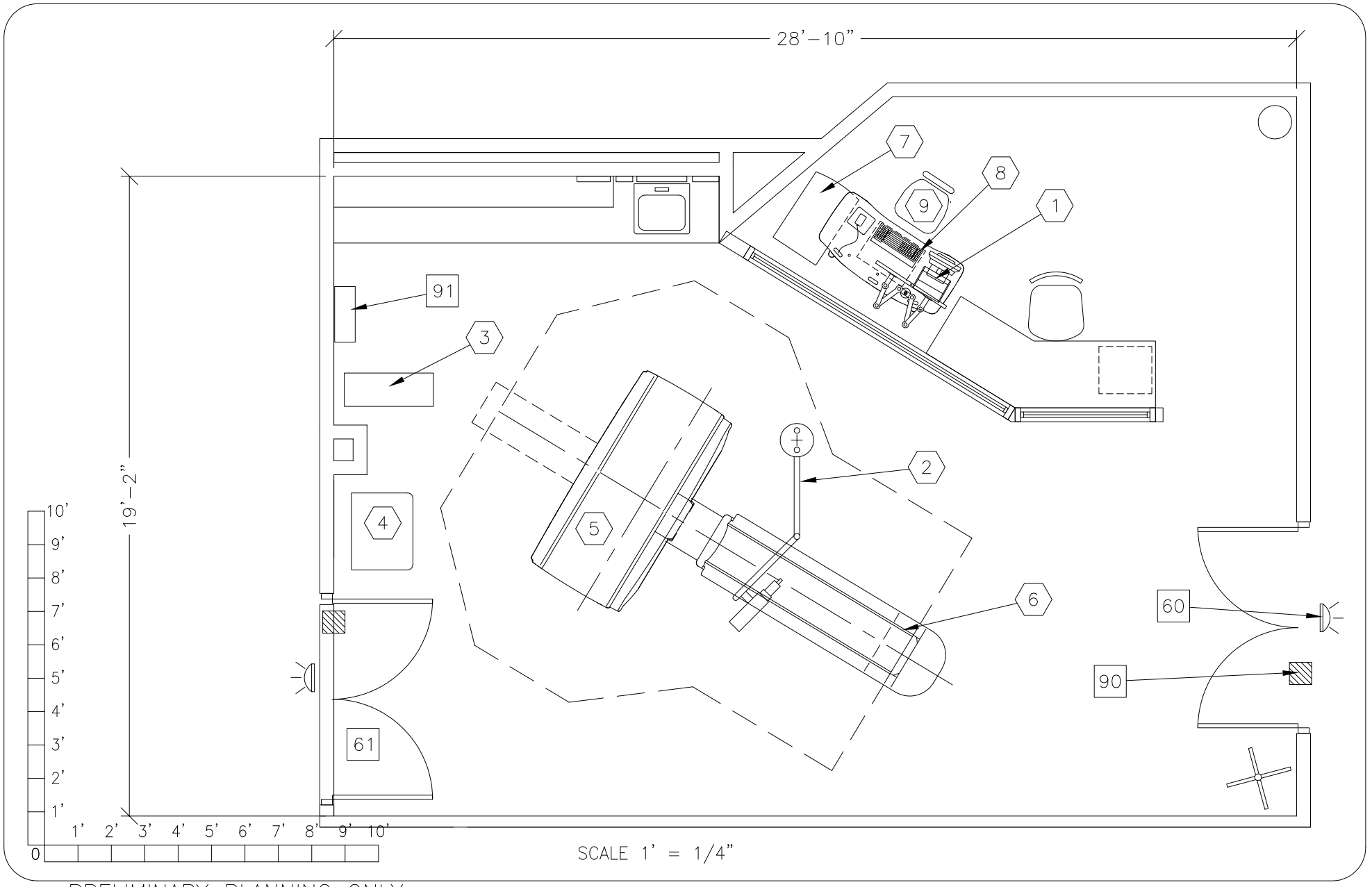
APPENDIX – B

Shielding Diagram: CT Scanner Room



Shielding Legend

	1/16" Pb Shielding
	3/32" Pb Shielding
	1/8" Pb Shielding



PRELIMINARY PLANNING ONLY

PROJECT TITLE:

VA – LEBANON
OPTIMA CT660
Lebanon, PA

SCHEME NO.: 13PAC017 DRAWN BY: KL DATE: 01/31/13

THIS LAYOUT **MUST** BE APPROVED BEFORE FINAL DRAWINGS CAN BE STARTED. THANK YOU

CUSTOMER _____ DATE: _____

GE INSTALL. SPECIALIST _____ DATE: _____

GE Healthcare

Modality Installation Planning

Milwaukee, Wisconsin

GE EQUIPMENT LISTING

EQUIPMENT QUOTED FROM GE MEDICAL SYSTEMS
PER QUOTE NO. XXX-XXXXXX DATED XX/XX/XX
INSTALLED BY GEMS

ITEM NO.	QUANTITY ORDERED	ITEM DESCRIPTION (* = EXISTING/REINSTALL)	WEIGHT	HEAT OUTPUT
1	1	INJECTOR CONTROL AND ELECTRONICS	22 lbs	320 btu
2	1	INJECTOR HEAD ON OVERHEAD COUNTERPOISED SUSPENSION.	79 lbs	
3	1	UPS SYSTEM	350 lbs	3399 btu
4	1	POWER DISTRIBUTION UNIT	815 lbs	3412 btu
5	1	CT OPTIMA CT660 GANTRY	3990 lbs	18703 btu
6	1	GT1700 PATIENT TABLE WITH EXTENDED TABLE TOP (W/500 lb PATIENT)	1543 lbs	1023 btu
7	1	FREEDOM WORKSPACE SMALL TABLE	97 lbs	
8	1	CONSOLE CABINET & LCD MONITORS	216 lbs	3201 btu
9	1	OPERATOR'S CHAIR		

ANCILLARY ITEMS

CUSTOMER/CONTRACTOR SUPPLIED AND INSTALLED ITEMS

ITEM NO. ☐	ITEM DESCRIPTION (* INDICATES EXISTING)
60	X-RAY ON WARNING LIGHT - AVAILABLE FROM GE SUPPLY CALL: 800-200-9760 GE CAT. NO. WXIABWW-0F-XIU
61	MINIMUM DOOR OPENING FOR EQUIPMENT DELIVERY IS 44 IN. W x 83 IN. H [1118mm x 2108mm], CONTINGENT ON A 96 IN. [2438mm] CORRIDOR WIDTH

THE FOLLOWING ITEMS ARE AVAILABLE FROM THE GE MEDICAL SYSTEMS SERVICE DEPARTMENT. CONTACT YOUR LOCAL GE MEDICAL SYSTEMS SERVICE REPRESENTATIVE FOR PRICING AND AVAILABILITY OR CALL 1-800-558-2040.

90	X-RAY ROOM WARNING LIGHT CONTROL PANEL REFERENCE JUNCTION POINT 'WLC' ON SHEET 'E1' FOR DETAILED DESCRIPTION -E4502RL FOR WARNING LIGHT CONTROL ONLY.
91	MAIN DISCONNECT CONTROL GEMS CAT. NO. E4502AB 90 lbs., SEE DETAIL R4502AD. (IF A UPS IS NOT OR WILL NOT BE ORDERED, THE E4502AD CAN BE USED.)

THE CUSTOMER MUST PROVIDE ONE INTERNET ACCESSIBLE (VPN) NETWORK CONNECTION UNLESS BASED UPON SYSTEM CONFIGURATION THAT A DEDICATED DATA TELEPHONE LINE IS ACCEPTABLE

POWER SPECIFICATIONS

Optima CT660 Series

(REV. DATE 29.MAY.12)

VOLTAGE

PRIMARY SOURCE IS REQUIRED FOR ALL INSTALLATIONS. RANGE OF LINE VOLTAGES: NOMINAL LINE VOLTAGE OF 380 TO 480, 3 PHASE, 50 OR 60 Hz.

REQUIRED POWER SUPPLY: WYE CONNECTED

MAXIMUM DAILY VOLTAGE VARIATION MUST FALL WITHIN ONE OF THE RANGES IN TABLE A.

TABLE A ALLOWABLE INPUT VOLTAGES/ CURRENT DEMAND

NOMINAL VOLTAGE	ABSOLUTE RANGE	CURRENT (AMPS)		MINIMUM STANDARD OVERCURRENT PROTECTION
		MOMENTARY	CONTINUOUS	
380	342–418	152	30	110–A
400	360–440	144	29	110–A
420	378–462	137	27	100–A
440	396–484	131	26	100–A
460	414–506	126	25	90–A
480	432–528	120	24	90–A

(ALL CALCULATIONS BASED UPON NOMINAL VOLTAGE)

PHASE–BALANCE.

PHASE–TO–PHASE VOLTAGES MUST BE WITHIN +2 PERCENT OF THE LOWEST PHASE–TO–PHASE VOLTAGE. MAXIMUM ALLOWABLE TRANSIENT VOLTAGE SHOULD BE LIMITED TO 1500V PEAK.

VOLTAGE TRANSIENT OR IMPULSE ON THE INCOMING POWER MUST BE HELD TO A MINIMUM. TRANSIENTS CAUSED BY LIGHTNING, SURGES, LOAD SWITCHING, STATIC ELECTRICITY ETC. CAN CAUSE SCAN ABORTS OR, IN EXTREME INSTANCES, COMPONENT FAILURE IN THE COMPUTER SUBSYSTEM.

POWER DEMAND

CONTINUOUS POWER DEMAND = 20 KVA (MAX DEMAND = 100 KVA)

TABLE B MAXIMUM MOMENTARY POWER DEMAND.

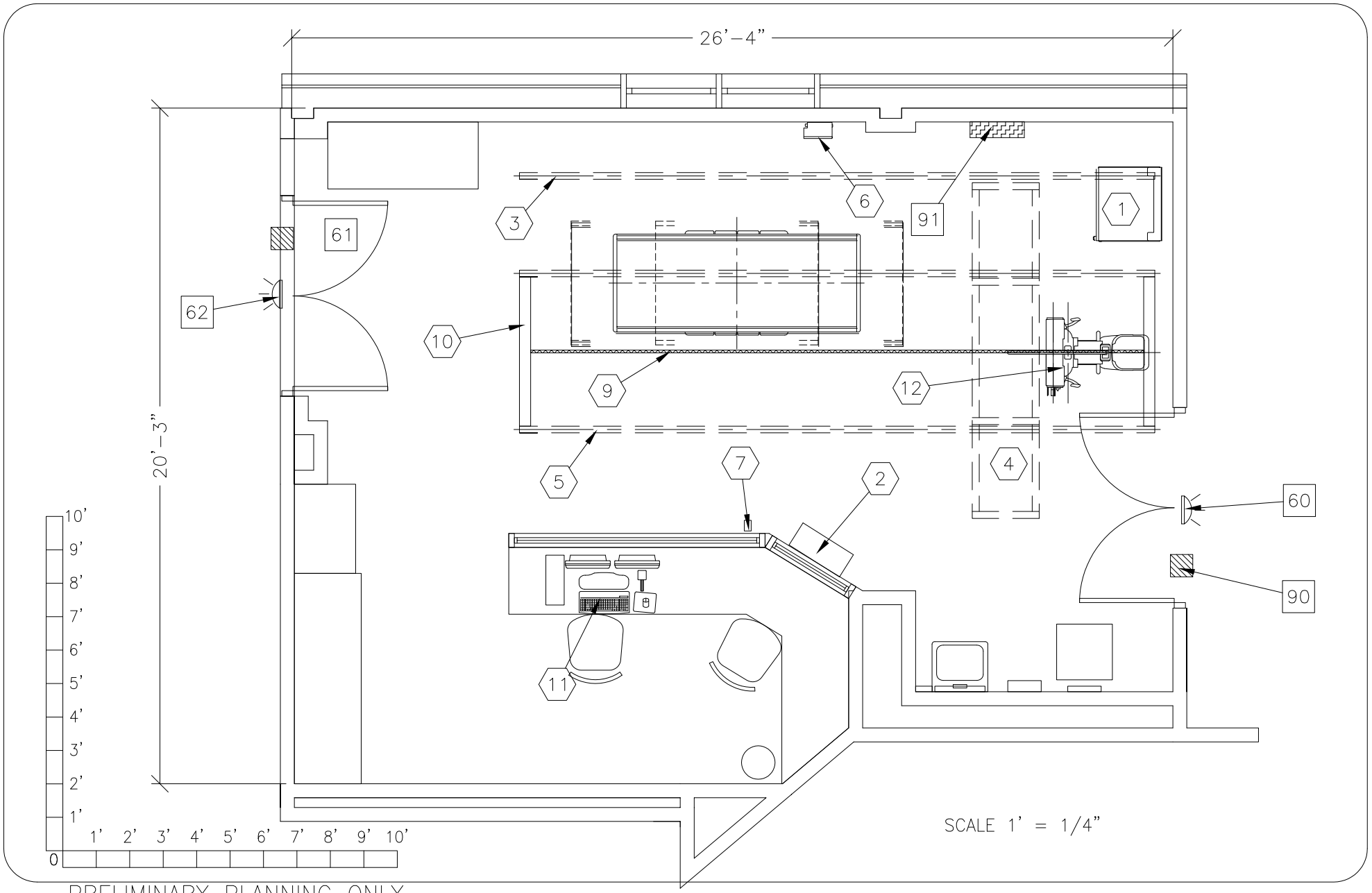
DEMAND	CT
kVa *	100
POWER FACTOR AT	0.85

* DEMAND INCLUDES POWER FOR ENTIRE CT SYSTEM. LINE VOLTAGE REGULATION AT MAXIMUM POWER DEMAND MUST BE LESS THAN OR EQUAL TO 6 PERCENT.

DISTRIBUTION TRANSFORMER

FOR A SINGLE UNIT INSTALLATION, THE MINIMUM TRANSFORMER SIZE IS 125 KVA, WITH 2.4% RATED REGULATION AT UNITY POWER FACTOR. RESULTANT MAXIMUM ALLOWABLE FEEDER REGULATION IS 3.6%

NOTE: THE CT SYSTEM MUST NOT BE POWERED IN A MULTIPLE INSTALLATION WHERE FILM CHANGERS ARE USED. FILM CHANGERS UTILIZE A LARGE NUMBER OF HIGH POWERED CLOSELY SPACED EXPOSURES WHICH MAY COINCIDE WITH THE CT SCAN.



PRELIMINARY PLANNING ONLY

PROJECT TITLE:

VA – LEBANON
DISCOVERY XR656
Lebanon, PA

SCHEME NO.: 13PAC018 DRAWN BY: KL DATE: 01/31/13

THIS LAYOUT **MUST** BE APPROVED BEFORE FINAL DRAWINGS CAN BE STARTED. THANK YOU

CUSTOMER _____ DATE: _____

GE INSTALL. SPECIALIST _____ DATE: _____

GE Healthcare

Modality Installation Planning

Milwaukee, Wisconsin

GE EQUIPMENT LISTING

EQUIPMENT QUOTED FROM GE MEDICAL SYSTEMS
PER QUOTE NO. XXX-XXXXXX DATED XX/XX/XX
INSTALLED BY GEMS

ITEM NO.	QUANTITY ORDERED	ITEM DESCRIPTION (* = EXISTING/REINSTALL)	WEIGHT	HEAT OUTPUT
1	1	SYSTEM CABINET	679 lbs	2440 btu
2	1	GRID HOLDER <FIELD VERIFY IDEAL LOCATION>	30 lbs	
3	1	CABLE DRAPE RAIL.	180 lbs	
4	1	XT RADIOGRAPHIC SUSPENSION WITH INBOARD MOUNTING.	784 lbs	102 btu
5	2	LONGITUDINAL STATIONARY RAIL FOR XT SUSPENSION	68 lbs	
6	1	TETHER INTERFACE BOX	15 lbs	10 btu
7	1	DONGLE	4 lbs	
8	1	XR 656 DIGITAL ELEVATING TABLE	992 lbs	372 btu
9	1	LONGITUDINAL DRIVE BELT 1 IN. WIDE	44 lbs	
10	2	ANCHOR RAILS		
11	1	OPERATORS CONSOLE	79 lbs	604 btu
12	1	DIGITAL CHEST UNIT	595 lbs	136 btu

POWER SPECIFICATIONS

XR656 JEDI 80kw SYSTEMS CABINET

REV. DATE: 11/22/10

VOLTAGE

PRIMARY SOURCE IS REQUIRED FOR ALL INSTALLATIONS.
RANGE OF LINE VOLTAGES :
NOMINAL LINE VOLTAGE OF 380 TO 480, 3 PHASE, WITHOUT NEUTRAL, 50 OR 60 Hz.

REQUIRED POWER SUPPLY: WYE DISTRIBUTION

MAXIMUM DAILY VOLTAGE VARIATION MUST FALL WITHIN ONE OF THE RANGES IN TABLE A.

TABLE A ALLOWABLE INPUT VOLTAGES/ CURRENT DEMAND

NOMINAL VOLTAGE	NORMAL RANGE ±10 PERCENT	CURRENT (AMPS)		MINIMUM OVERCURRENT PROTECTION
		MAX. MOMENTARY	CONTINUOUS	
380	342–418	190	7	95–A
400	360–440	180	6.7	90–A
415	373–456	170	6.2	85–A
440	396–484	163	6	82–A
460	414–506	156	5.7	78–A
480	432–528	150	5.5	75–A

ALL CALCULATIONS BASED UPON NOMINAL VOLTAGE

NOTE

LOW LINE CONDITIONS MAY INHIBIT SOME HIGH kVp TECHNIQUES. THE GENERATOR AUTOMATICALLY ESTABLISHES THESE INHIBITS BASED ON ACTUAL LINE CONDITIONS AND SYSTEM REGULATION.

PHASE–BALANCE.

PHASE–TO–PHASE VOLTAGES MUST BE WITHIN +2 PERCENT OF THE LOWEST PHASE–TO–PHASE VOLTAGE. MAXIMUM ALLOWABLE TRANSIENT VOLTAGE EXCURSIONS ARE 2.5 PERCENT OF RATED LINE VOLTAGE AT A MAXIMUM DURATION OF 5 CYCLES AND FREQUENCY OF 10 TIMES PER HOUR.

POWER DEMAND

CONTINUOUS POWER DEMAND =4.6 KVA. (MAX DEMAND = 125 KVA)

TABLE B MAXIMUM MOMENTARY POWER DEMAND.

DEMAND	XR656 JEDI 80 KW
kVa *	125
POWER FACTOR AT	0.73
mA	630
kVp	80

* DEMAND INCLUDES POWER FOR ENTIRE SYSTEM. LINE VOLTAGE REGULATION AT MAXIMUM POWER DEMAND MUST BE LESS THAN OR EQUAL TO 6 PERCENT.

DISTRI–BUTION TRANS–FORMER

FOR A SINGLE UNIT INSTALLATION, THE MINIMUM TRANSFORMER SIZE IS 150 KVA.

APPENDIX C

HEATING, VENTILATION and AIR CONDITIONING (HVAC)

Table 7-1 CLIMATIC CONDITIONS

Location	Weather Station	North Latitude	MSL Elevation	Col. 1a 0.4%		Col. 1b 99.6%	Col. 2a 1%		Col. 2b 99%	Col. 3 Wet Bulb		Annual Extreme Daily-Mean Db	
				Temperatures									
				Summer		Winter	Summer		Winter	0.4%	1%	Maximum	Minimum
				Db	Wb	Db	Db	Wb	Db				
Oklahoma City	Oklahoma City Will Rogers World AP	35.39	1306	99.5	74.1	11.4	96.8	74.1	17.4	77.7	76.7	102.7	6.1
OREGON													
Portland	Portland Intl AP	45.59	108	91.2	67.5	23.9	87.1	66.5	28.6	69.4	67.8	99.0	20.5
Roseburg*	Roseburg AP	43	505	93	69	18	90	67	18	-	-	-	-
White City	Medford Rogue Valley Intl AP	42.39	1329	98.6	67.2	22.9	95.3	65.9	25.7	69.0	67.5	104.2	18.1
PENNSYLVANIA													
Altoona	Altoona Blair Co AP	40.30	1470	88.5	72.0	4.7	85.7	70.7	9.6	74.7	73.2	92.5	-2.6
Butler*	Butler Co (AWOS)	40.78	1247	88.0	72.4	3.1	84.4	70.6	8.9	74.6	73.0	91.1	-2.3
Coatesville*	New Castle	41	825	91	75	2	88	74	2	-	-	-	-
Erie	Erie Intl AP	42.08	738	86.4	72.9	5.2	84.0	71.6	9.7	75.3	73.8	91.5	-0.5
Lebanon	Harrisburg Capital City AP	40.22	348	92.4	73.8	8.7	89.6	72.5	13.3	76.5	75.2	96.3	1.6
Philadelphia	Philadelphia Intl AP	39.87	30	93.2	75.4	12.6	90.6	74.5	16.9	78.3	77.0	97.0	6.6
Pittsburgh	Pittsburgh Intl AP	40.50	1204	89.5	72.5	3.7	86.6	71.1	9.4	75.2	73.7	92.4	-3.0
Wilkes-Barre	Wilkes-Barre Scranton Intl AP	41.34	961	88.9	72.1	3.5	86.0	70.6	8.3	75.0	73.3	93.0	-2.7
PUERTO RICO													
San Juan	San Juan Intl AP	18.42	62	91.4	77.4	69.1	89.6	77.8	70.2	80.6	79.9	93.9	66.8

IMAGING SERIES - AIR HANDLING UNIT	
AHU System Data Sheet	
Air Handling Type	Variable Air Volume
Indoor Design Temperature	Room Data Sheets
Indoor Design Relative Humidity	Room Data Sheets
Minimum Total Air Changes Per Hour	Room Data Sheets
Minimum Outdoor Air Changes Per Hour	Room Data Sheets
Return Air Permitted	Room Data Sheets
Exhaust Air Required	Room Data Sheets
Air Economizer Cycle Required	Yes
Heat Recovery System Required	ASHRAE Standard 90.1 - 2007
Filtration - Pre-Filters (PF-1 and PF-2)	PF-1 = MERV 7 and PF-2 = MERV 11
Filtration - After-Filter (AF)	AF = MERV 14
Cooling Source	Chilled Water
Heating Source	Steam ~~and/or Hot Water~~
Humidification Source	~~Plant Steam or~~ "Clean Steam"
General Exhaust System Required	Yes
Special Exhaust System Required	Yes
Emergency Power Required	MRI Unit Emergency Exhaust Fan Associated Controls
Individual Room Temperature Control Required	Room Data Sheets
Room Air Balance	Room Data Sheets

~~**Note 1 - MRI (Magnetic Resonance Imaging) Unit**~~

(a) Reference Document

MRI Design Guide published by the VA Office of Construction and Facilities Management: This Publication contains valuable information about the space layout , equipment list, exhaust system and utility requirements. A design guide plate for each room shows tentative room dimensions and equipment layout.

(b) Coordination

Capacity and configuration of the MRI Unit varies by manufacturer. Coordination with the project specific MRI vendor is mandatory. Coordinate vibration isolation requirement of AHU(s) sited in proximity to the MRI scanner.

(c) RF Shielding

For HVAC ducts and pipes penetrating RF shielding of the MRI Scanning Room, coordinate penetration requirements with MRI system manufacturer, RF shield vendor, and architectural discipline.

IMAGING SERIES - AIR HANDLING UNIT
AHU System Data Sheet
Note 2 - Radiology Service **(a) Reference Document** Radiology Service Design Guide published by the VA Office of Construction and Facility Management: This publication contains valuable information about the space layout, equipment list, and utilities requirements. A design guide plate for each room shows tentative room dimensions and the equipment layout. **(b) Shielded Walls and Ceilings** For HVAC ducts and pipes penetrating shielded walls and ceilings, ensure coordination with the architectural discipline and provide treatment as specified by the equipment manufacturer and medical physicist.
~~**Note 3 - Nuclear Medicine**~~ **(a) Reference Document** Nuclear Medicine Design Guide published by the VA Office of Construction and Facilities Management: This publication contains valuable information about the space layout, equipment list, and utilities requirements. A design guide plate for each room shows tentative room dimensions and the equipment layout. **(b) Exhaust Systems** Provide a special exhaust system(s) for fume hoods and biological safety cabinets. Coordinate hood locations and sizes with the architectural discipline. For radioisotope hoods, coordinate the need for HEPA filters or Carbon Filters or both or no filters with the VA Safety Officer. **(c) Shielded Walls and Ceilings** For HVAC ducts and pipes penetrating shielded walls and ceilings, ensure coordination with the architectural discipline and provide treatment as specified by the equipment manufacturer and medical physicist.
~~**NOTE 4 - Radiation Therapy Service**~~ **(a) Reference Document** Radiation Therapy Service Design Guide published by the VA Office of Construction and Facilities Management: This publication contains valuable information about the space layout, equipment list, and utilities requirements. A design guide plate for each room shows tentative room dimensions and the equipment layout. **(b) Shielded Walls and Ceilings** For HVAC ducts and pipes penetrating shielded walls and ceilings, ensure coordination with the architectural discipline and provide treatment as specified by the equipment manufacturer and medical physicist.
NOTE 5 - Indoor Design Conditions Indoor design conditions may vary from Room Data Sheets to meet the requirements of the selected equipment.
NOTE 6 - Design Documents The Room Data Sheets indicate generic requirements of various equipment in the Imagining Series. If the details of the selected equipment are not known when design documents are issued, provide a design based on information in the Room Data Sheets and based on an agreed vendor. The purpose is to provide a reasonable level of documentation for construction pricing and bidding.

IMAGING SERIES (RADIOLOGY SERVICES) - ROOM DATA SHEET													
ROOM NAME	INDOOR TEMPERATURE				INDOOR RELATIVE HUMIDITY		MIN TOTAL ACH	MIN OA ACH	ROOM AIR RETURN EXHAUST (G) EXHAUST (S)	MAX NOISE LEVEL NC	ROOM AIR BALANCE	INDIVIDUAL ROOM CONTROL	
	COOLING		HEATING		% RH MAX	% RH MIN						TEMP	FLOW
	F	C	F	C									
CT Area - Control Room	75	24	70	21	60	20	12	2	Return	35	(+)	Yes	CV
Note - None													
CT Area - Scanning Room	75	24	70	21	60	20	12	2	Return	35	(+)	Yes	CV
Note - None													
IR Area - Special Procedure (SP) Control Room	75	24	70	21	60	20	15	2	Return	35	(+)	Yes	CV
Note - None													
IR Area - SP Room	75	24	70	21	60	20	15	2	Return	35	(+)	Yes	CV
Note - None													
IR Area - SP System Component Room	70	21	70	21	60	20	15	2	Return	35	(+)	Yes	CV
Note - None													
Patient Area - Chest Room	75	24	70	21	60	20	6	2	Return	35	(+)	Yes	CV
Note - None													
Patient Area - General Purpose Radiology Room	75	24	70	21	60	20	6	2	Return	35	(+)	Yes	CV
Note - None													
Patient Area - Mammography Room	75	24	70	21	60	20	6	2	Return	35	(+)	Yes	CV
Note - None													

IMAGING SERIES (RADIOLOGY SERVICES) - ROOM DATA SHEET													
ROOM NAME	INDOOR TEMPERATURE				INDOOR RELATIVE HUMIDITY		MIN TOTAL ACH	MIN OA ACH	ROOM AIR RETURN EXHAUST (G) EXHAUST (S)	MAX NOISE LEVEL NC	ROOM AIR BALANCE	INDIVIDUAL ROOM CONTROL	
	COOLING		HEATING		% RH	% RH						TEMP	FLOW
	F	C	F	C	MAX	MIN							
Patient Area - Radiographic/Fluoroscopic Room	75	24	70	21	60	20	6	2	Exhaust (G)	35	(-)	Yes	CV
Note 1 - Air Balance Maintain negative room air balance in adjoining toilet.													
Patient Area - Ultrasound Room	75	24	70	21	60	20	6	2	Return	35	(+)	Yes	CV
Note 1 - Air Balance Maintain negative room air balance in adjoining toilet.													
Radiology Waiting Room	75	24	70	21	60	20	12	2	Exhaust (G)	40	(-)	Yes	CV
Note 1 - Air Distribution Design air distribution system to move air towards the waiting patients.													

LEBANON VA - CT/RADIOLOGY RM FOR EMERGENCY DEPARTMENT

Prepared by **Miller-Remick LLC; Cherry Hill, NJ**
for **LEBANON VA**
Miller-Remick Project No. 0499-0019
2/13/2013

ZONE/ROOM TABULATION
AND UTILITY SUMMARY

Zone No.	Description	System		Dimensions			HVAC Loads									Ventilation Air							Min Supply Air		Exhaust Air		
							Cooling			Heating					Heat'g w/ Infilt.					User								
		AHU	Floor	Area	Ceiling	Volume										No. of People	OA/sq.ft	OA/person	Air Changes			Total	Air Changes	Total	Air Changes	User *(cfm)*	Total
		#	#	*sq.ft*	*ft*	*cu.ft*	*Btu/h -sen*	*Btu/h - lat*	*SHR*	*Btu/h -sen*	*Btu/h - lat*	*SHR*	Perim?		*Btu/h -sen*		*cfm*	*cfm*	*ac/h*	*cfm*	*vent eff*	*cfm*	*ac/h*	*cfm*	*ac/h*	*other cfm*	*cfm*
1	CT	*3*	*1*	450	9.0	4,050	34,912	1000	0.97	1304	--	1.00	X	1,304	1,814	4	0.06	5	2.00		90%	150	12	825			0
2	X-RAY	*3*	*1*	365	9.0	3,285	7,957	1000	0.89	1058	--	1.00	X	1,058	1,472	4	0.06	5	2.00		90%	125	6	350			0
3	X-RAY CONTROL RM	*3*	*1*	120	9.0	1,080	2,616	500	0.84	348	--	1.00	X	348	484	2	0.06	5	2.00		90%	40	6	125			0
4	CT CONTROL RM	*3*	*1*	135	9.0	1,215	5,886	500	0.92	391	--	1.00	X	391	544	2	0.06	5	2.00		90%	45	12	250			0
5	EXISTING WAITING	*2*	*1*																							300	-300
6	EXISTING ICU CORRIDOR	*1*	*1*																								
Sum of Peaks				1,070		9,630	51,371	3,000	0.94	3,101	0	1.00		3,101	4,314	12	12	Act. Occ. (min. 50% of calc'd occ. for vent air)				360				0	0

LEBANON VA - CT/RADIOLOGY RM FOR EMERGENCY DEPARTMENT

Prepared by **Miller-Remick LLC; Cherry Hill, NJ**
for **LEBANON VA**
Miller-Remick Project No. 0499-0019
2/13/2013

ZONE/ROOM TABULATION
AND UTILITY SUMMARY

Zone No.	Description	Air System Caculations																	
		SA Volume Req'd							ASHRAE 62		Air Balance				Reheat Coil		
		Max (calc)	Min (calc)	User (max)	User (min)	Turndn	Checks		Z-factor		SA	EA	TA	RA	Capacity	Req'd	Balance
		cfm	*cfm*	*cfm*	*cfm*		*ac/h*	*cfm/sq.ft*	*at Max*	*at Min*	*cfm*	*cfm*	*cfm*	*cfm*	*Btu/h*	*gpm*	*gpm*
1	CT	1,650	1,650	1,650	1,650	1.00	24	3.67	0.09	0.09	1,650	0	-300	-1,350	98,010	9.8	10.0
2	X-RAY	400	400	400	400	1.00	7	1.10	0.31	0.31	400	0	-300	-100	23,760	2.4	2.5
3	X-RAY CONTROL RM	125	125			1.00	7	1.04	0.32	0.32	125	0		-125	7,425	0.7	1.0
4	CT CONTROL RM	275	275		275	1.00	14	2.04	0.16	0.16	275	0		-275	16,335	1.6	2.0
5	EXISTING WAITING										0	-300	600	-300			
6	EXISTING ICU CORRIDOR										0	0	300	-300			
Sum of Peaks		2,450	2,450			1.00	15	2.29	0.15	0.15	**2,450**	**-300**	**300**	**-2,450**	145,530	14.6	15.5
									X-factor:	0.13	0.13	Min OA @ Max SA:		**445**	cfm		
									Y-factor:	0.16	0.16	Min OA @Min SA:		**445**	cfm		

UTILITY SUMMARY			
CHW	HW	LPS	CLPS
gpm	*gpm*	*lb/h*	*lb/h*
18	16	219	17

PROJECT INFORMATION

Location	
Building owner	
Program user	
Company	
Comments	

By	**Miller-Remick**
Dataset name	**C:\Users\mprzybylski\Documents\TRACE 700 Projects\LEBANON - CTRAD.TRC**
Calculation time	**05:17 PM on 02/10/2013**
TRACE® 700 version	**6.2.9**
Location	**Harrisburg, Pennsylvania**
Latitude	**40.0 deg**
Longitude	**76.0 deg**
Time Zone	**5**
Elevation	**335 ft**
Barometric pressure	**29.5 in. Hg**
Air density	**0.0751 lb/cu ft**
Air specific heat	**0.2444 Btu/lb·°F**
Density-specific heat product	**1.1011 Btu/h·cfm·°F**
Latent heat factor	**4,846.9 Btu·min/h·cu ft**
Enthalpy factor	**4.5046 lb·min/hr·cu ft**
Summer design dry bulb	**92 °F**
Summer design wet bulb	**77 °F**
Winter design dry bulb	**0 °F**
Summer clearness number	**1.00**
Winter clearness number	**1.00**
Summer ground reflectance	**0.20**
Winter ground reflectance	**0.20**
Carbon Dioxide Level	**400 ppm**
Design simulation period	**January - December**
Cooling load methodology	**RTS (ASHRAE Tables)**
Heating load methodology	**UATD**

Room Checksums

By Miller-Remick

Room - 001 - CT

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 92 / 77 / 115

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	969	969	2
Glass Solar	0	0	0	0
Glass/Door Cond	0	0	0	0
Wall Cond	0	0	0	0
Partition/Door	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	396		396	1
Sub Total ==>	396	969	1,365	3
Internal Loads				
Lights	3,072	0	3,072	7
People	2,000	0	2,000	4
Misc	26,537	0	26,537	57
Sub Total ==>	31,609	0	31,609	68
Ceiling Load	969	-969	0	0
Ventilation Load	0	0	7,918	17
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	0		0	0
Exhaust Heat		-294	-294	-1
Sup. Fan Heat			2,986	6
Ret. Fan Heat		3,000	3,000	6
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	32,974	2,706	46,584	100.00

CLG SPACE PEAK

Mo/Hr: 7 / 15
OADB: 92

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	0	0
Glass/Door Cond	0	0
Wall Cond	0	0
Partition/Door	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	129	0
Sub Total ==>	129	0
Internal Loads		
Lights	3,072	10
People	1,000	3
Misc	26,537	84
Sub Total ==>	30,609	96
Ceiling Load	1,000	3
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	0	0
Grand Total ==>	31,738	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 0

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-1,304	5.26
Glass Solar	0	0	0.00
Glass/Door Cond	0	0	0.00
Wall Cond	0	0	0.00
Partition/Door	0	0	0.00
Floor	0	0	0.00
Adjacent Floor	0	0	0.00
Infiltration	-520	-520	2.10
Sub Total ==>	-520	-1,824	7.36
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-1,304	0	0.00
Ventilation Load	0	-10,405	41.99
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	0	0	0.00
Exhaust Heat		0	0.00
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-12,549	50.64
Additional Reheat		0	0.00
System Plenum Heat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-1,824	-24,778	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	72.1
Ra Plenum	81.8	60.9
Return	76.9	70.0
Ret/OA	78.3	58.3
Fn MtrTD	0.2	0.0
Fn BldTD	0.4	0.0
Fn Frict	1.3	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	1,441	810
Terminal	1,441	810
Main Fan	1,441	810
Sec Fan	0	0
Nom Vent	135	135
AHU Vent	135	135
Infil	7	7
MinStop/Rh	810	810
Return	1,448	817
Exhaust	142	142
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	9.4	16.7
cfm/ft²	3.20	1.80
cfm/ton	371.26	
ft²/ton	115.92	
Btu/hr·ft²	103.52	-55.06
No. People	4	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter gr/lb	Leave DB °F	Leave WB °F	Leave gr/lb
Main Clg	3.9	46.6	39.9	1,440	78.3	63.0	62.8	53.1	51.8	56.1
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	3.9	46.6								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	450		
Part	0		
Int Door	0		
ExFlr	0		
Roof	450	0	0
Wall	0	0	0
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-16.9	810	53.1	72.1
Aux Htg	0.0	0	0.0	0.0
Preheat	-7.9	135	0.0	53.1
Reheat	-15.1	810	53.1	70.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-24.8			

Room Checksums

By Miller-Remick

Room - 002 - X-Ray

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 15
Outside Air: OADB/WB/HR: 92 / 76 / 114

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	811	811	5
Glass Solar	0	0	0	0
Glass/Door Cond	0	0	0	0
Wall Cond	0	0	0	0
Partition/Door	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	320		320	2
Sub Total ==>	320	811	1,131	7
Internal Loads				
Lights	1,993	0	1,993	12
People	2,000	0	2,000	13
Misc	3,060	0	3,060	19
Sub Total ==>	7,053	0	7,053	44
Ceiling Load	811	-811	0	0
Ventilation Load	0	0	6,396	40
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	265		265	2
Exhaust Heat		-238	-238	-1
Sup. Fan Heat			681	4
Ret. Fan Heat		693	693	4
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	8,449	454	15,980	100.00

CLG SPACE PEAK

Mo/Hr: 7 / 15
OADB: 92

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	0	0
Glass/Door Cond	0	0
Wall Cond	0	0
Partition/Door	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	105	1
Sub Total ==>	105	1
Internal Loads		
Lights	1,993	28
People	1,000	14
Misc	3,060	42
Sub Total ==>	6,053	84
Ceiling Load	811	11
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	265	4
Exhaust Heat		
OA Preheat Diff.		
RA Preheat Diff.		
Additional Reheat		
System Plenum Heat		
Underflr Sup Ht Pkup		
Supply Air Leakage		
Grand Total ==>	7,234	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 0

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-1,058	7.56
Glass Solar	0	0	0.00
Glass/Door Cond	0	0	0.00
Wall Cond	0	0	0.00
Partition/Door	0	0	0.00
Floor	0	0	0.00
Adjacent Floor	0	0	0.00
Infiltration	-422	-422	3.02
Sub Total ==>	-422	-1,480	10.58
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-1,058	0	0.00
Ventilation Load	0	-8,440	60.32
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	0	0	0.00
Exhaust Heat		0	0.00
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-4,071	29.10
Additional Reheat		0	0.00
System Plenum Heat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-1,480	-13,991	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	74.1
Ra Plenum	82.0	60.9
Return	76.9	70.0
Ret/OA	82.1	46.7
Fn MtrTD	0.2	0.0
Fn BldTD	0.4	0.0
Fn Frict	1.3	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	329	329
Terminal	329	329
Main Fan	329	329
Sec Fan	0	0
Nom Vent	110	110
AHU Vent	110	110
Infil	5	5
MinStop/Rh	329	329
Return	334	334
Exhaust	115	115
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	33.3	33.3
cfm/ft²	0.90	0.90
cfm/ton	246.68	
ft²/ton	274.09	
Btu/hr·ft²	43.78	-38.33
No. People	4	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter gr/lb	Leave DB °F	Leave WB °F	Leave gr/lb
Main Clg	1.3	16.0	10.5	329	82.1	67.0	76.3	53.1	50.8	52.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1.3	16.0								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	365		
Part	0		
Int Door	0		
ExFlr	0		
Roof	365	0	0
Wall	0	0	0
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-7.6	329	53.1	74.1
Aux Htg	0.0	0	0.0	0.0
Preheat	-6.4	110	0.0	53.1
Reheat	-6.1	329	53.1	70.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-14.0			

Room Checksums

By Miller-Remick

Room - 003 - Control Room - X-Ray

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 15
Outside Air: OADB/WB/HR: 92 / 76 / 114

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	267	267	5
Glass Solar	0	0	0	0
Glass/Door Cond	0	0	0	0
Wall Cond	0	0	0	0
Partition/Door	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	105		105	2
Sub Total ==>	105	267	372	7
Internal Loads				
Lights	614	0	614	11
People	1,000	0	1,000	18
Misc	809	0	809	15
Sub Total ==>	2,423	0	2,423	45
Ceiling Load	267	-267	0	0
Ventilation Load	0	0	2,103	39
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	154		154	3
Exhaust Heat		-78	-78	-1
Sup. Fan Heat			224	4
Ret. Fan Heat		228	228	4
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	2,949	149	5,425	100.00

CLG SPACE PEAK

Mo/Hr: 7 / 15
OADB: 92

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	0	0
Glass/Door Cond	0	0
Wall Cond	0	0
Partition/Door	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	34	1
Sub Total ==>	34	1
Internal Loads		
Lights	614	26
People	500	21
Misc	809	34
Sub Total ==>	1,923	81
Ceiling Load	267	11
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	154	6
Exhaust Heat		
OA Preheat Diff.		
RA Preheat Diff.		
Additional Reheat		
System Plenum Heat		
Underflr Sup Ht Pkup		
Supply Air Leakage		
Grand Total ==>	2,378	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 0

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-348	7.56
Glass Solar	0	0	0.00
Glass/Door Cond	0	0	0.00
Wall Cond	0	0	0.00
Partition/Door	0	0	0.00
Floor	0	0	0.00
Adjacent Floor	0	0	0.00
Infiltration	-139	-139	3.02
Sub Total ==>	-139	-486	10.58
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-348	0	0.00
Ventilation Load	0	-2,775	60.32
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	0	0	0.00
Exhaust Heat		0	0.00
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-1,339	29.10
Additional Reheat		0	0.00
System Plenum Heat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-486	-4,600	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	74.1
Ra Plenum	82.0	60.9
Return	76.9	70.0
Ret/OA	82.1	46.7
Fn MtrTD	0.2	0.0
Fn BldTD	0.4	0.0
Fn Frict	1.3	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	108	108
Terminal	108	108
Main Fan	108	108
Sec Fan	0	0
Nom Vent	36	36
AHU Vent	36	36
Infil	2	2
MinStop/Rh	108	108
Return	110	110
Exhaust	38	38
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	33.3	33.3
cfm/ft²	0.90	0.90
cfm/ton	238.89	
ft²/ton	265.44	
Btu/hr·ft²	45.21	-38.33
No. People	2	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	0.5	5.4	3.4	108	82.1	67.0	76.3	53.1	50.2	50.1
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.5	5.4								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	120		
Part	0		
Int Door	0		
ExFlr	0		
Roof	120	0	0
Wall	0	0	0
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-2.5	108	53.1	74.1
Aux Htg	0.0	0	0.0	0.0
Preheat	-2.1	36	0.0	53.1
Reheat	-2.0	108	53.1	70.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-4.6			

Room Checksums

By Miller-Remick

Room - 004 - Control Room - CT

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 92 / 77 / 115

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	291	291	3
Glass Solar	0	0	0	0
Glass/Door Cond	0	0	0	0
Wall Cond	0	0	0	0
Partition/Door	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	119		119	1
Sub Total ==>	119	291	410	4
Internal Loads				
Lights	691	0	691	7
People	1,000	0	1,000	11
Misc	3,751	0	3,751	41
Sub Total ==>	5,443	0	5,443	59
Ceiling Load	291	-291	0	0
Ventilation Load	0	0	2,375	26
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	80		80	1
Exhaust Heat		-88	-88	-1
Sup. Fan Heat			504	5
Ret. Fan Heat		508	508	6
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	5,932	420	9,232	100.00

CLG SPACE PEAK

Mo/Hr: 7 / 15
OADB: 92

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	0	0
Glass/Door Cond	0	0
Wall Cond	0	0
Partition/Door	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	39	1
Sub Total ==>	39	1
Internal Loads		
Lights	691	13
People	500	9
Misc	3,751	70
Sub Total ==>	4,943	92
Ceiling Load	300	6
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	70	1
Grand Total ==>	5,351	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 0

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-391	5.26
Glass Solar	0	0	0.00
Glass/Door Cond	0	0	0.00
Wall Cond	0	0	0.00
Partition/Door	0	0	0.00
Floor	0	0	0.00
Adjacent Floor	0	0	0.00
Infiltration	-156	-156	2.10
Sub Total ==>	-156	-547	7.36
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-391	0	0.00
Ventilation Load	0	-3,122	41.99
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	0	0	0.00
Exhaust Heat		0	0.00
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-3,765	50.64
Additional Reheat		0	0.00
System Plenum Heat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-547	-7,433	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	72.1
Ra Plenum	81.8	60.9
Return	76.9	70.0
Ret/OA	79.4	58.3
Fn MtrTD	0.2	0.0
Fn BldTD	0.4	0.0
Fn Frict	1.3	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	243	243
Terminal	243	243
Main Fan	243	243
Sec Fan	0	0
Nom Vent	41	41
AHU Vent	41	41
Infil	2	2
MinStop/Rh	243	243
Return	245	245
Exhaust	43	43
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	16.7	16.7
cfm/ft²	1.80	1.80
cfm/ton	315.86	
ft²/ton	175.48	
Btu/hr·ft²	68.38	-55.06
No. People	2	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter gr/lb	Leave DB °F	Leave WB °F	Leave gr/lb
Main Clg	0.8	9.2	7.0	243	79.4	64.3	67.0	53.1	51.3	54.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.8	9.2								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	135		
Part	0		
Int Door	0		
ExFlr	0		
Roof	135	0	0
Wall	0	0	0
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-5.1	243	53.1	72.1
Aux Htg	0.0	0	0.0	0.0
Preheat	-2.4	41	0.0	53.1
Reheat	-4.5	243	53.1	70.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-7.4			

Performance Climate Changer

Job Name	Miller Remick VA Lebanon Bldg 101 and Bldg 22
User Name	(T92)Andrew Bees
Address	Philadelphia Main Office

Performance Climate Changer — AHU 101-3

Quantity 1

Job Comments

Coil performance data is certified in accordance with AHRI standard 410. Propylene glycol and calcium chloride, or mixtures thereof, are not covered under the scope of AHRI 410.

Air-handling performance data is certified in accordance with AHRI standard 430. Air handlers with plenum fans and vertical draw-thru air handlers where the coil is mounted immediately below the fan section are not covered under the scope of AHRI 430.

All weights and dimensions are approximate. Certified prints on request.

Performance Climate Changer

Unit level options — **Module Position:** 0

Actual airflow	2700 cfm	Installed weight	5091.5 lb
Unit elevation	0.00 ft	Rigging weight	5034.2 lb
Unit size	8	Single or front discharge - 63 Hz	75 dB
Integral base frame	6in. integral base frame	Single or front discharge - 125 Hz	83 dB
UL listed unit	UL listed unit	Single or front discharge - 250 Hz	82 dB
Circuit number 1	Supply fan motor(s)	Single or front discharge - 500 Hz	88 dB
FLA (CV) circuit 1	11.00 A	Single or front discharge - 1K Hz	81 dB
MCA circuit 1	13.75 A	Single or front discharge - 2K Hz	86 dB
MOP circuit 1	24.75 A	Single or front discharge - 4K Hz	76 dB
Fuse size circuit 1	20.00 A	Single or front discharge - 8K Hz	74 dB
Circuit number 2	Return/booster fan motor(s)	Inlet and casing - 63 Hz	94 dB
FLA (CV) circuit 2	4.80 A	Inlet and casing - 125 Hz	95 dB
MCA circuit 2	6.00 A	Inlet and casing - 250 Hz	89 dB
MOP circuit 2	10.80 A	Inlet and casing - 500 Hz	92 dB
Fuse size circuit 2	15.00 A	Inlet and casing - 1K Hz	83 dB
Circuit number 3	Lights + switch	Inlet and casing - 2K Hz	84 dB
FLA (CV) circuit 3	2.61 A	Inlet and casing - 4K Hz	88 dB
MCA circuit 3	3.26 A	Inlet and casing - 8K Hz	79 dB
MOP circuit 3	5.87 A	Ducted inlet - 63 Hz	81 dB
Fuse size circuit 3	15.00 A	Ducted inlet - 125 Hz	82 dB
Circuit number 4	Receptacle	Ducted inlet - 250 Hz	83 dB
FLA (CV) circuit 4	8.00 A	Ducted inlet - 500 Hz	86 dB
MCA circuit 4	10.00 A	Ducted inlet - 1K Hz	75 dB
MOP circuit 4	18.00 A	Ducted inlet - 2K Hz	76 dB
Fuse size circuit 4	15.00 A	Ducted inlet - 4K Hz	75 dB
Product group	Outdoor unit	Ducted inlet - 8K Hz	71 dB
Roof curb type	Pier or pad mounted unit	Casing - 63 Hz	82 dB
Modified coil - min face velocity	250 ft/min	Casing - 125 Hz	80 dB
Modified coil - max face velocity	600 ft/min	Casing - 250 Hz	79 dB
HEPA filter - min face velocity	0 ft/min	Casing - 500 Hz	83 dB
HEPA filter - max face velocity	600 ft/min	Casing - 1K Hz	78 dB
High voltage location	Right	Casing - 2K Hz	69 dB
Length	436.505 in	Casing - 4K Hz	61 dB
Width	50.500 in	Casing - 8K Hz	59 dB

Controls and VFD/starter — **Module Position:** 0

Factory controls package	No factory mount	Design Sequence	C
Automatic Selection	Validation Only	Number of transformers	1 - Transformer
Controller mounting	No mount	Prepackaged solution option used	MP common configuration not used
Controller type	No controller	Prepackaged solution valid unit	Non valid MP common configuration
LCD screen and keypad	No LCD	Total number of control points	2 control points

Warranty — **Module Position:** 0

Warranty section	Std. warranty only

Coil performance data is certified in accordance with AHRI standard 410. Propylene glycol and calcium chloride, or mixtures thereof, are not covered under the scope of AHRI 410.

Air-handling performance data is certified in accordance with AHRI standard 430. Air handlers with plenum fans and vertical draw-thru air handlers where the coil is mounted immediately below the fan section are not covered under the scope of AHRI 430.

All weights and dimensions are approximate. Certified prints on request.

Performance Climate Changer

Air mixing section **Module Position:** 1

Section type	Air mixing section	Right side opening type	No opening
Unit size	8	Left side opening type	No opening
Mixing section type	reduced length	Design sequence	D
Access door location	Both	Opening 1 bottom - airflow	2700 cfm
Back opening type	No opening	Opening 1 back - airflow	2700 cfm
Back inlet type	Unducted	Opening 1 front - airflow	2700 cfm
Front opening type	Full face opening	Opening 1 bottom - face velocity	1346 ft/min
Front air path	Leaving	Opening 1 bottom - pressure drop	0.884 in H2O
Top opening type	No opening	Opening 1 bottom total pressure drop	0.884 in H2O
Bottom opening type	High velocity parallel damper	Greatest entry PD	0.884 in H2O
Bottom air path	Entering	Opening 1 front - area	10.09 sq ft
Bottom air path type	Return	Opening 1 bottom - area	2.01 sq ft
Bottom inlet type	Ducted		

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Performance Climate Changer

Fan section

Module Position: 2

Fan sec [7]-1

Section type	Fan	Static pressure origin	Program calculated
Fan application	Return fan	Single or front discharge - 63 Hz	65 dB
Unit size	8	Single or front discharge - 125 Hz	68 dB
Inlet location	Back inlet	Single or front discharge - 250 Hz	78 dB
Fan orientation	Plenum fan	Single or front discharge - 500 Hz	74 dB
Fan discharge	Front top	Single or front discharge - 1K Hz	70 dB
Access door location	Both	Single or front discharge - 2K Hz	78 dB
Drive location	Right side drive	Single or front discharge - 4K Hz	64 dB
Design sequence	G	Single or front discharge - 8K Hz	56 dB
Motor horsepower per fan	3 hp	Inlet and casing - 63 Hz	92 dB
NEMA nominal motor efficiency	89.50 %	Inlet and casing - 125 Hz	87 dB
Motor class	NEMA premium compliant ODP	Inlet and casing - 250 Hz	89 dB
Motor voltage	460/3	Inlet and casing - 500 Hz	90 dB
Cycle	60 cycles/sec	Inlet and casing - 1K Hz	83 dB
Drive service factor	Direct drive	Inlet and casing - 2K Hz	83 dB
Motor RPM	1800	Inlet and casing - 4K Hz	88 dB
Marine light	Marine LED light	Inlet and casing - 8K Hz	79 dB
Fan airflow	2700 cfm	Ducted inlet - 63 Hz	81 dB
Overall ESP	2.000 in H2O	Ducted inlet - 125 Hz	79 dB
Unit entering ESP	1.000 in H2O	Ducted inlet - 250 Hz	83 dB
Unit discharge ESP	1.000 in H2O	Ducted inlet - 500 Hz	85 dB
Elevation	0.00 ft	Ducted inlet - 1K Hz	75 dB
Minimum temperature	40.00 F	Ducted inlet - 2K Hz	76 dB
Design temperature	70.00 F	Ducted inlet - 4K Hz	75 dB
Fan size and type	16.5in. direct-drive plenum, full width	Ducted inlet - 8K Hz	71 dB
Total brake horsepower	2.148 hp	Casing - 63 Hz	77 dB
Total brake horsepower at min temp	2.277 hp	Casing - 125 Hz	70 dB
Total static pressure	3.449 in H2O	Casing - 250 Hz	77 dB
Speed	2103 rpm	Casing - 500 Hz	76 dB
Fan module pressure drop	2.011 in H2O	Casing - 1K Hz	75 dB
Section height	41.250 in	Casing - 2K Hz	66 dB
Section length	44.000 in	Casing - 4K Hz	59 dB
Section width	50.500 in	Casing - 8K Hz	55 dB
Section weight	676.1 lb		

Economizer section

Module Position: 3

Economizer section type	Return fan economizer	Exhaust air damper type	Parallel blade damper
Outside air location	Left	Exhaust air hood type	Exhaust hood w/ bird screen
Outside air damper type	Parallel blade damper	Supply fan total air PD	0.224 in H2O
Outside air hood type	OA - hood w/eliminators	Exhaust fan total air PD	0.553 in H2O
Return air damper type	Parallel blade damper		

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Air-handling performance data is certified in accordance with AHRI standard 430. Air handlers with plenum fans and vertical draw-thru air handlers where the coil is mounted immediately below the fan section are not covered under the scope of AHRI 430.

All weights and dimensions are approximate. Certified prints on request.

Performance Climate Changer

Filter section

Module Position: 4

Section type	Filter	Filter area	8.00 sq ft
Unit size	8	Filter face velocity	338 ft/min
Filter type	Short Bag/Cartridge filter	Filter pressure drop	0.676 in H2O
Filter frame	Bag/cartridge filter frame	Prefilter pressure drop	0.587 in H2O
Access door location	Both	Filter section pressure drop	1.264 in H2O
Primary filter type 1	12in. cartridge - 65% eff - MERV 11	Section length	26.500 in
Prefilter filter type	2" Coated pleated media - MERV 7	Section width	50.500 in
Design sequence	C	Section height	41.250 in
Filter airflow	2700 cfm	Section weight	268.3 lb
Filter condition	Mid-life		

Controls section

Module Position: 5

Section type	Starter/VFD only	Ret/Exh fan high voltage door	Right
Unit size	Unit size 8	Design sequence	B
Starter/VFD	Return/exhaust section	Section length	24.500 in
NEMA application type	Internal NEMA	Section width	50.500 in
Access door location	Left	Section height	41.250 in
Access door swing direction	Outward swing	Section weight	271.9 lb

Coil section

Module Position: 6

Coil se [4]-1

Section type	Horizontal coil	Entering dry bulb	0.00 F
Unit size	8	Leaving dry bulb	70.95 F
Section size	IFB - medium large (1-3 rows)	Total capacity	207.86 MBh
Coil application	Heating coil	Coil fluid percentage	0.00 %
Changeover coil	No	Steam pressure	15.00 psig
System type	Steam IFB	Coil face velocity	523 ft/min
Coil supply/cabinet side	Right	Air pressure drop	0.261 in H2O
Coil height	Integral face & bypass	J trap dimension	2.593 in
IFB - coil size	B-30 horiz IFB coil	H trap dimension	5.185 in
IFB - coil rows	2 rows	Coil condensate	219.00 lb/hr
IFB - fins per inch	10 fins per inch	Coil installed weight	288.4 lb
Drain pan	No drain pan	Coil section pressure drop	0.261 in H2O
Design sequence	D	Section length	26.500 in
Apply AHRI ranges	Yes	Section height	41.250 in
Coil performance airflow	2700 cfm	Section width	50.500 in
Coil elevation	0.00 ft	Section weight	488.1 lb

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Air-handling performance data is certified in accordance with AHRI standard 430. Air handlers with plenum fans and vertical draw-thru air handlers where the coil is mounted immediately below the fan section are not covered under the scope of AHRI 430.

All weights and dimensions are approximate. Certified prints on request.

Performance Climate Changer

Access section

Module Position: 7

Section type	Access/blank/turning	Design sequence	B
Unit size	8	Marine light	Marine LED light
Section size	Extended medium	Section length	19.000 in
Access door location	Both	Section width	50.500 in
Door swing direction	Outward swing	Section height	41.250 in
Front opening	Full Face	Section weight	140.3 lb
Back opening	Full Face		

Coil section

Module Position: 8

Coil se [6]-1

Section type	Horizontal coil	Coil fluid percentage	100.00 %
Unit size	8	Target valve pressure drop	4.00 psig
Section size	Extended medium	Coil type	W
Coil application	Cooling coil	Rows	6 rows
Changeover coil	No	Fin type	Prima flo H (Hi efficient)
System type	Chilled water	Fin material	Aluminum fins
Coil supply/cabinet side	Right	Tube diameter	5/8in. tube diameter (15.875 mm)
Coil casing	Galvanized	Tube matl/wall thickness	.020" (0.508mm) copper tubes
Coil height	Unit coil height	Turbulators	Yes
Drain pan	Stainless steel	Corrosion resistant coating	None
Drain connection location	Right	Coil face velocity	369 ft/min
Design sequence	D	Air pressure drop	0.336 in H2O
Apply AHRI ranges	Yes	J trap dimension	2.761 in
Coil performance airflow	2700 cfm	H trap dimension	5.521 in
Coil elevation	0.00 ft	Leaving fluid temperature	54.00 F
Entering dry bulb	78.00 F	Fluid pressure drop	1.47 ft H2O
Entering wet bulb	63.00 F	Fluid volume	6.85 gal
Leaving dry bulb	52.00 F	Fluid velocity	1.10 ft/s
Leaving wet bulb	51.36 F	Coil face area	7.31 sq ft
Sensible capacity	77.06 MBh	Coil rigging weight	170.4 lb
Total capacity	89.83 MBh	Coil installed weight	227.7 lb
Fin spacing	99 Per Foot	Coil section pressure drop	0.336 in H2O
Entering fluid temperature	44.00 F	Section length	19.000 in
Fluid temperature rise	10.00 F	Section height	41.250 in
Standard fluid flow rate	17.90 gpm	Section width	50.500 in
Coil fouling factor	0.00000 hr-sq ft-deg F/Btu	Section weight	391.0 lb
Fluid type	Water		

Coil performance data is certified in accordance with AHRI standard 410. Propylene glycol and calcium chloride, or mixtures thereof, are not covered under the scope of AHRI 410.

Air-handling performance data is certified in accordance with AHRI standard 430. Air handlers with plenum fans and vertical draw-thru air handlers where the coil is mounted immediately below the fan section are not covered under the scope of AHRI 430.

Performance Climate Changer

Access section — **Module Position:** 9

Section type	Access/blank/turning	Design sequence	B
Unit size	8	Marine light	Marine LED light
Section size	Medium	Section length	14.000 in
Access door location	Both	Section width	50.500 in
Door swing direction	Outward swing	Section height	41.250 in
Front opening	Full Face	Section weight	105.3 lb
Back opening	Full Face		

Humidification section — **Module Position:** 10

Humidif [8]-1

Section type	Humidifier	EDB	55.00 F
Steam source	Atmospheric	Entering RH	47.00 %
Control type	Electronic control	Leaving RH	59.00 %
High limit sensor	High limit sensor	Steam rate	16.13 lb/hr
Control valve trap	Cast iron trap	Humidifier section PD	0.004 in H2O
Actual airflow	2700 cfm		

Access section — **Module Position:** 11

Section type	Access/blank/turning	Design sequence	B
Unit size	8	Marine light	Marine LED light
Section size	Large	Section length	36.000 in
Access door location	Both	Section width	50.500 in
Door swing direction	Outward swing	Section height	41.250 in
Front opening	Full Face	Section weight	270.0 lb
Back opening	Full Face		

Coil performance data is certified in accordance with AHRI standard 410. Propylene glycol and calcium chloride, or mixtures thereof, are not covered under the scope of AHRI 410.

Air-handling performance data is certified in accordance with AHRI standard 430. Air handlers with plenum fans and vertical draw-thru air handlers where the coil is mounted immediately below the fan section are not covered under the scope of AHRI 430.

Performance Climate Changer

Fan section

Module Position: 12

Fan sec [7]-1

Section type	Fan	Static pressure origin	Program calculated
Fan application	Supply fan	Single or front discharge - 63 Hz	75 dB
Unit size	8	Single or front discharge - 125 Hz	83 dB
Inlet location	Back inlet	Single or front discharge - 250 Hz	81 dB
Fan orientation	Plenum fan	Single or front discharge - 500 Hz	88 dB
Fan discharge	Front top	Single or front discharge - 1K Hz	81 dB
Access door location	Both	Single or front discharge - 2K Hz	86 dB
Drive location	Right side drive	Single or front discharge - 4K Hz	76 dB
Design sequence	G	Single or front discharge - 8K Hz	74 dB
Motor horsepower per fan	7.5 hp	Inlet and casing - 63 Hz	90 dB
NEMA nominal motor efficiency	91.00 %	Inlet and casing - 125 Hz	95 dB
Motor class	NEMA premium compliant ODP	Inlet and casing - 250 Hz	83 dB
Motor voltage	460/3	Inlet and casing - 500 Hz	88 dB
Cycle	60 cycles/sec	Inlet and casing - 1K Hz	74 dB
Drive service factor	Direct drive	Inlet and casing - 2K Hz	79 dB
Motor RPM	1800	Inlet and casing - 4K Hz	78 dB
Marine light	Marine LED light	Inlet and casing - 8K Hz	70 dB
Fan airflow	2700 cfm	Ducted inlet - 63 Hz	74 dB
Overall ESP	3.000 in H2O	Ducted inlet - 125 Hz	80 dB
Unit entering ESP	1.500 in H2O	Ducted inlet - 250 Hz	76 dB
Unit discharge ESP	1.500 in H2O	Ducted inlet - 500 Hz	82 dB
Elevation	0.00 ft	Ducted inlet - 1K Hz	62 dB
Minimum temperature	40.00 F	Ducted inlet - 2K Hz	70 dB
Design temperature	70.00 F	Ducted inlet - 4K Hz	60 dB
Fan size and type	16.5in. direct-drive plenum, 80% width	Ducted inlet - 8K Hz	53 dB
Total brake horsepower	3.676 hp	Casing - 63 Hz	81 dB
Total brake horsepower at min temp	3.896 hp	Casing - 125 Hz	80 dB
Total static pressure	5.838 in H2O	Casing - 250 Hz	76 dB
Speed	2717 rpm	Casing - 500 Hz	83 dB
Fan module pressure drop	3.011 in H2O	Casing - 1K Hz	75 dB
Section height	41.250 in	Casing - 2K Hz	66 dB
Section length	44.000 in	Casing - 4K Hz	58 dB
Section width	50.500 in	Casing - 8K Hz	57 dB
Section weight	725.1 lb		

Access section

Module Position: 13

Section type	Access/blank/turning	Design sequence	B
Unit size	8	Section length	10.000 in
Section size	Small	Section width	50.500 in
Front opening	Full Face	Section height	41.250 in
Back opening	Full Face	Section weight	83.8 lb

Coil performance data is certified in accordance with AHRI standard 410. Propylene glycol and calcium chloride, or mixtures thereof, are not covered under the scope of AHRI 410.

Air-handling performance data is certified in accordance with AHRI standard 430. Air handlers with plenum fans and vertical draw-thru air handlers where the coil is mounted immediately below the fan section are not covered under the scope of AHRI 430.

All weights and dimensions are approximate. Certified prints on request.

Performance Climate Changer

Controls section — **Module Position:** 14

Section type	Starter/VFD only	Supply fan high voltage door	Right
Unit size	Unit size 8	Design sequence	B
Starter/VFD	Supply section	Section length	24.500 in
NEMA application type	Internal NEMA	Section width	50.500 in
Access door location	Left	Section height	41.250 in
Access door swing direction	Outward swing	Section weight	276.9 lb

Filter section — **Module Position:** 15

Section type	Filter	Filter condition	Mid-life
Unit size	8	Filter area	8.00 sq ft
Filter type	Short Bag/Cartridge filter	Filter face velocity	338 ft/min
Filter frame	Bag/cartridge filter frame	Filter pressure drop	0.706 in H2O
Access door location	Both	Filter section pressure drop	0.706 in H2O
Primary filter type 1	12in. cartridge - 95% eff - MERV 15	Section length	26.500 in
Prefilter filter type	No prefilter	Section width	50.500 in
Design sequence	C	Section height	41.250 in
Filter airflow	2700 cfm	Section weight	264.7 lb

Discharge plenum — **Module Position:** 16

Section type	Discharge plenum	Front total pressure drop	0.000 in H2O
Unit size	8	Top total pressure drop	0.000 in H2O
Mounting location and type	Horizontal standard length	Discharge 1 bottom - area	2.67 sq ft
Perforated panels	No	Discharge 1 bottom - pressure drop	0.032 in H2O
Design sequence	B	Bottom total pressure drop	0.032 in H2O
Discharge 1 bottom - airflow	2700 cfm	Right total pressure drop	0.000 in H2O
Back total pressure drop	0.000 in H2O	Left total pressure drop	0.000 in H2O

Coil performance data is certified in accordance with AHRI standard 410. Propylene glycol and calcium chloride, or mixtures thereof, are not covered under the scope of AHRI 410.

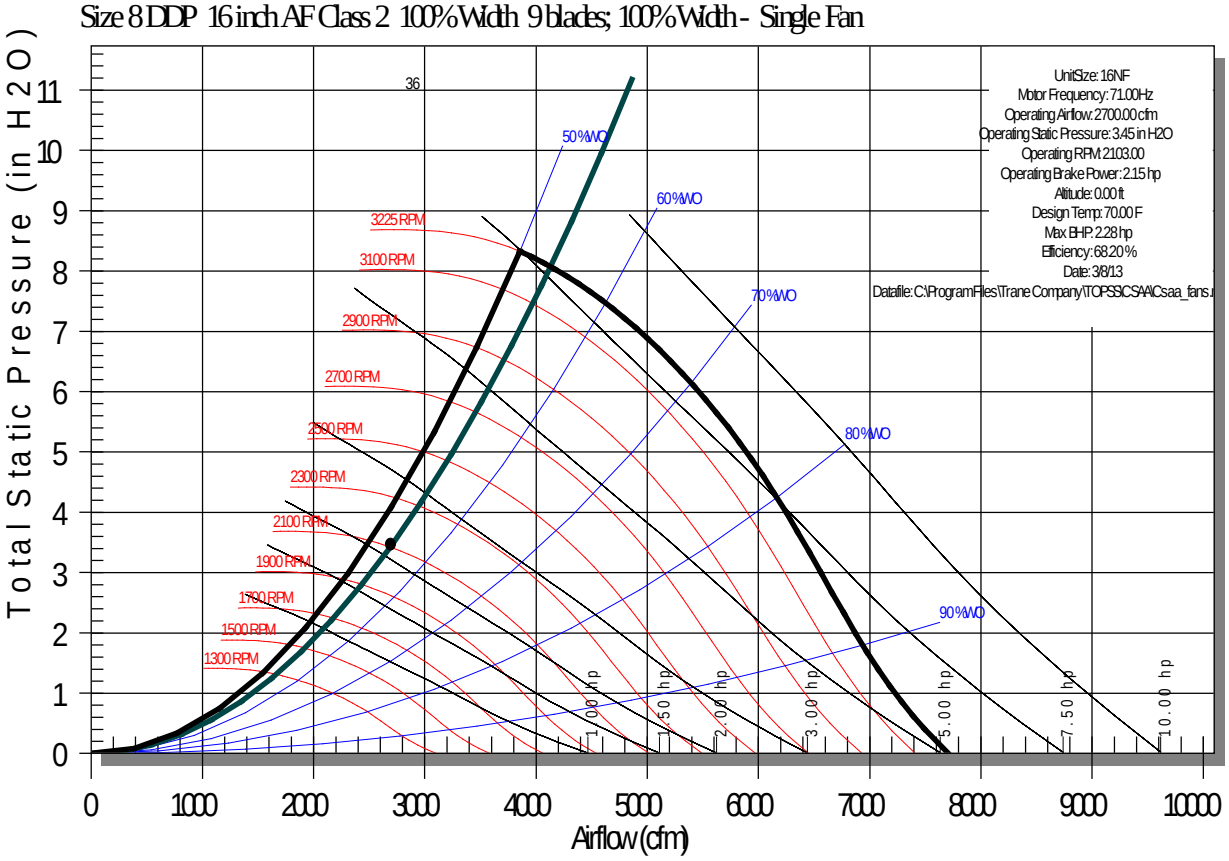
Air-handling performance data is certified in accordance with AHRI standard 430. Air handlers with plenum fans and vertical draw-thru air handlers where the coil is mounted immediately below the fan section are not covered under the scope of AHRI 430.

Overall Unit Acoustics

	63-Hz	125-Hz	250-Hz	500-Hz	1 k-Hz	2 k-Hz	4 k-Hz	8 k-Hz
Discharge	75	83	82	88	81	86	76	74
Inlet + Casing	94	95	89	92	83	84	88	79
Casing	82	80	79	83	78	69	61	59
Ducted Inlet	81	82	83	86	75	76	75	71

AHU 101-3 - Return Fan sec [7]-1

Size 8 DDP 16 inch AF Class 2 100% Width 9 blades; 100% Width - Single Fan



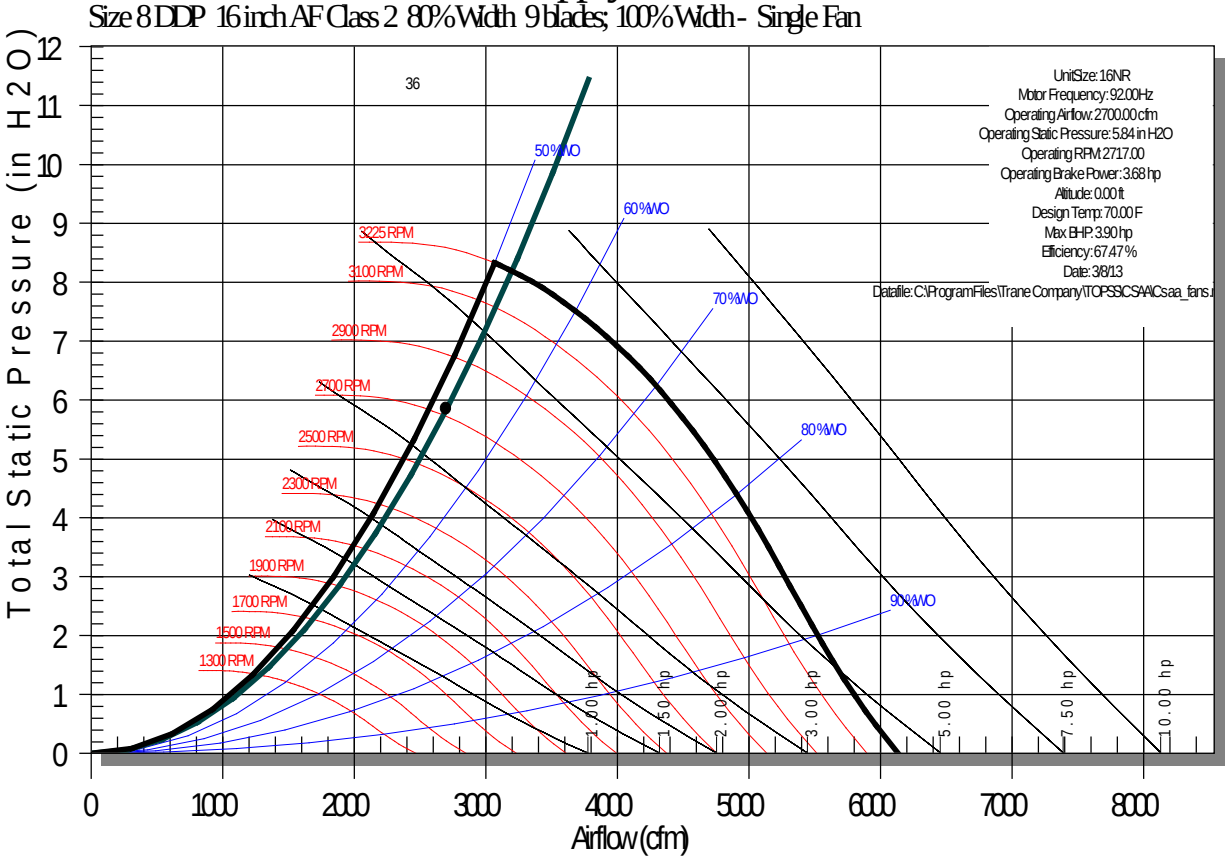
AHU 101-3 - Return Fan sec [7]-1

Size 8 DDP 16 inch AF Class 2 100% Width 9 blades; 100% Width

	63-Hz	125-Hz	250-Hz	500-Hz	1 k-Hz	2 k-Hz	4 k-Hz	8 k-Hz
Discharge	65	68	78	74	70	78	64	56
Inlet + Casing	92	87	89	90	83	83	88	79
Casing	77	70	77	76	75	66	59	55
Ducted Inlet	81	79	83	85	75	76	75	71

AHU 101-3 - Supply Fan sec [7]-1

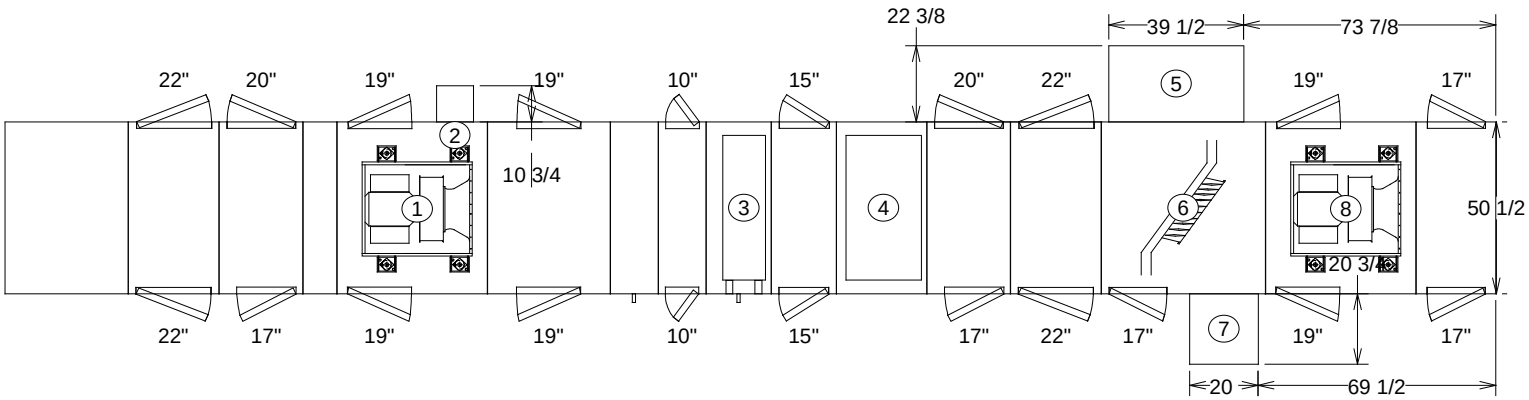
Size 8 DDP 16 inch AF Class 2 80% Width 9 blades; 100% Width - Single Fan

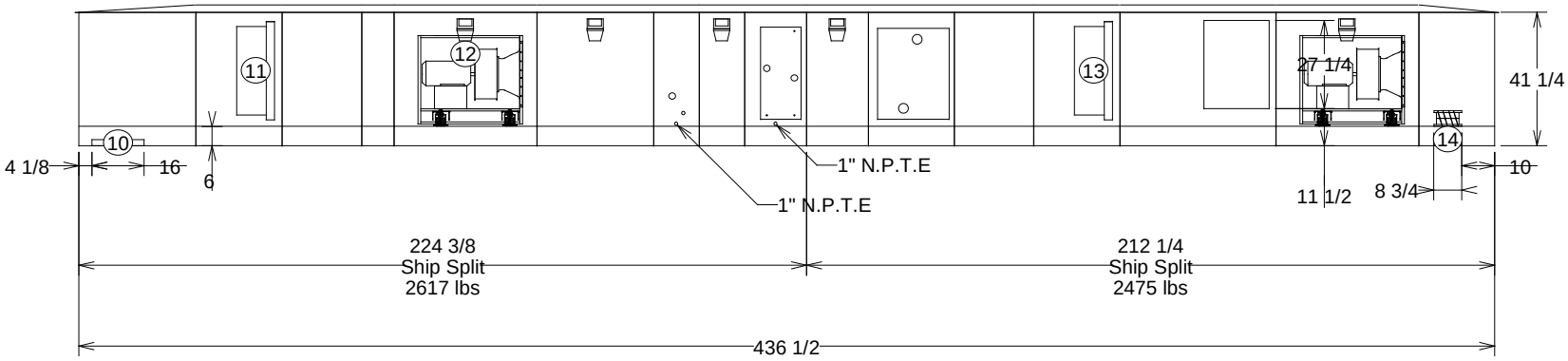


AHU 101-3 - Supply Fan sec [7]-1

Size 8 DDP 16 inch AF Class 2 80% Width 9 blades; 100% Width

	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Discharge	75	83	81	88	81	86	76	74
Inlet + Casing	90	95	83	88	74	79	78	70
Casing	81	80	76	83	75	66	58	57
Ducted Inlet	74	80	76	82	62	70	60	53





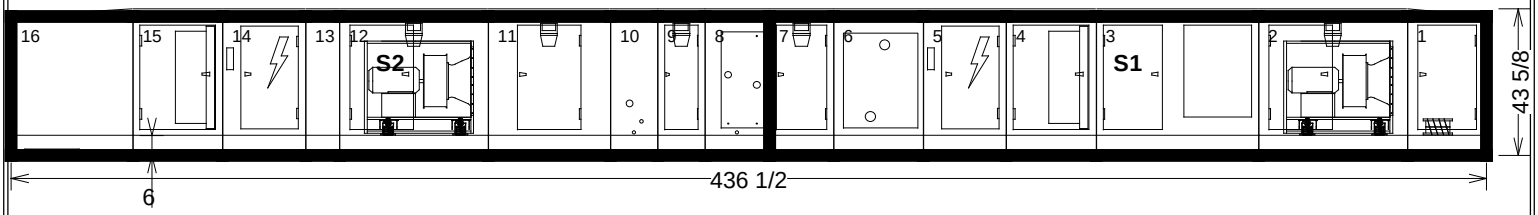
1 Plenum fan - 16.5in. direct-drive plenum, 80% width Supply fan 7.5 hp 460/3
2 Light switch and/or receptacle LH
3 Cooling coil - 6 rows Coil type W
4 Heating coil - Coil type
5 Hood left
6 Return air damper left
7 Hood right
8 Plenum fan - 16.5in. direct-drive plenum, full width Return fan 3 hp 460/3
9 1" N.P.T.E
10 Opening bottom 16.000 x 24.000
11 Cartridge filters - 12in. cartridge - 95% eff - MERV 15
12 Marine light (5)
13 Cartridge filters - 12in. cartridge - 65% eff - MERV 11
14 Damper bottom-parallel blade 8.750 x 35.500

Doors
22 width x 31 height
20 width x 31 height
19 width x 31 height
10 width x 31 height
15 width x 31 height
17 width x 31 height

For maneuvering purposes, include 1.125 inches to each ship split length for overlapping panel flange. Flange will not add to overall installed unit length shown.

OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

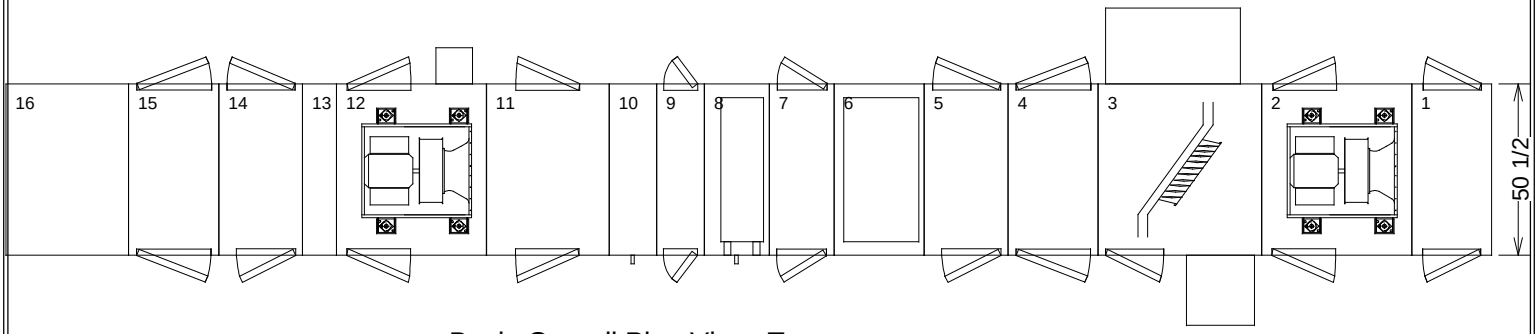
Unit size: 8	Job Name: Miller Remick VA Lebanon Bldg 101 and Bldg 22	Unit Casing: 2in Double Wall	TRANE® Performance Climate Changer™ Air Handlers
Product group: Outdoor unit	Actual airflow: 2700 cfm	Proposal Number:	
Integral base frame: 6in. integral base frame		Tags: AHU 101-3	
Paint: Factory painted - slate gray	Sales Office: Philadelphia Main Office	Rigging/Installed Weight: 5034.2 lb/ 5091.5 lb	



Overall Elevation View: Right - Shipping splits indicated by bold outline. - Measurements in inches

For maneuvering purposes, include 1.125 inches to each ship split length for overlapping panel flange. Flange will not add to overall installed unit length sh

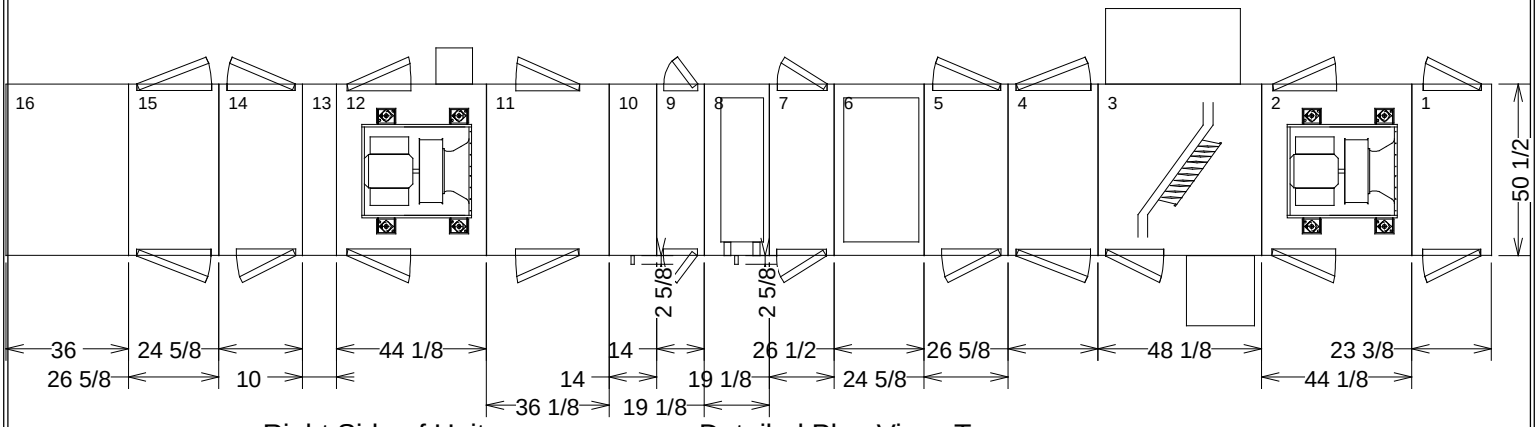
Pos #	Module	Length	Weight	Pos #	Module	Length	Weight
1	Air mixing section	23 3/8	217.94	14	Controls section	24 5/8	276.94
2	Fan section	44 1/8	676.09	15	Filter section	26 5/8	264.73
3	Economizer section	48 1/8	412.06	16	Discharge plenum	36	274.51
4	Filter section	26 5/8	268.33		Installed Unit Weight 5091.47 lbs		
5	Controls section	24 5/8	271.94				
6	Coil section	26 1/2	488.15				
7	Access section	19 1/8	140.29				
8	Coil section	19 1/8	390.99				
9	Access section	14	105.35				
10	Humidification section	14	225.35				
11	Access section	36 1/8	269.95				
12	Fan section	44 1/8	725.09				
13	Access section	10	83.78				



Basic Overall Plan View: Top - Measurements in inches

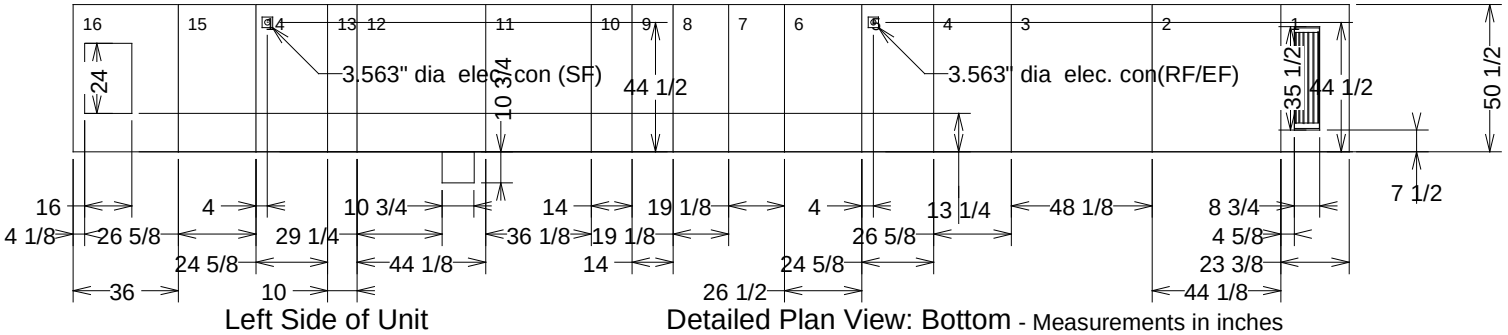
OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

Unit size: 8	Job Name: Miller Remick VA Lebanon Bldg 101 and Bldg 22	Unit Casing: 2in Double Wall	TRANE®
Product group: Outdoor unit	Actual airflow: 2700 cfm	Proposal Number:	Performance Climate Changer™ Air Handlers
Integral base frame: 6in. integral base frame		Tags: AHU 101-3	
Paint: Factory painted - slate gray	Sales Office: Philadelphia Main Office	Rigging/Installed Weight: 5034.2 lb/ 5091.5 lb	



Right Side of Unit

Detailed Plan View: Top - Measurements in inches

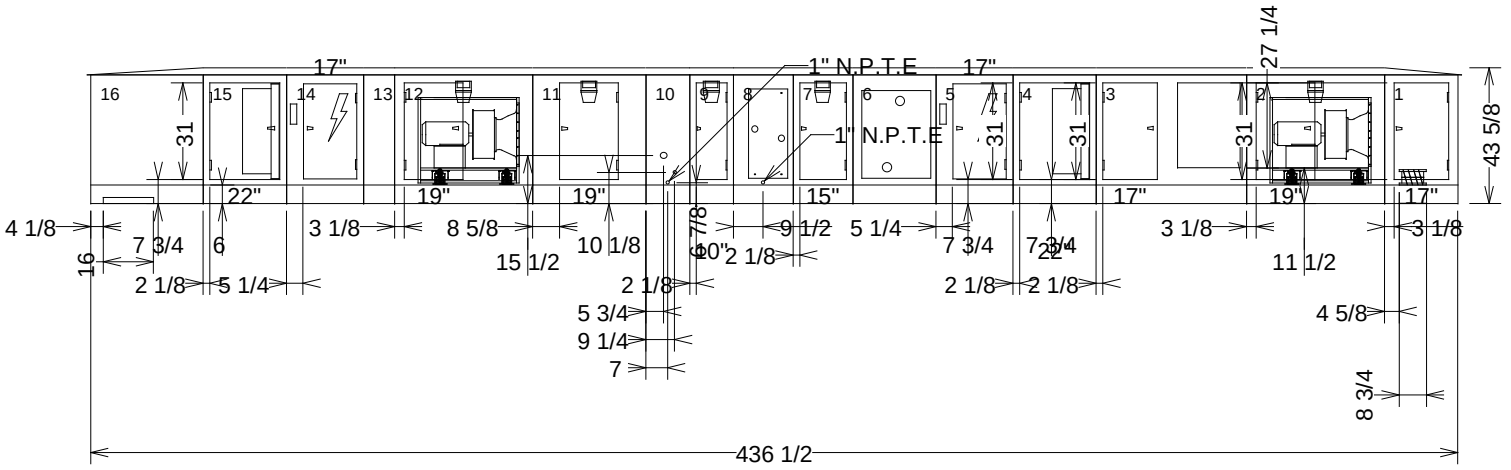


Left Side of Unit

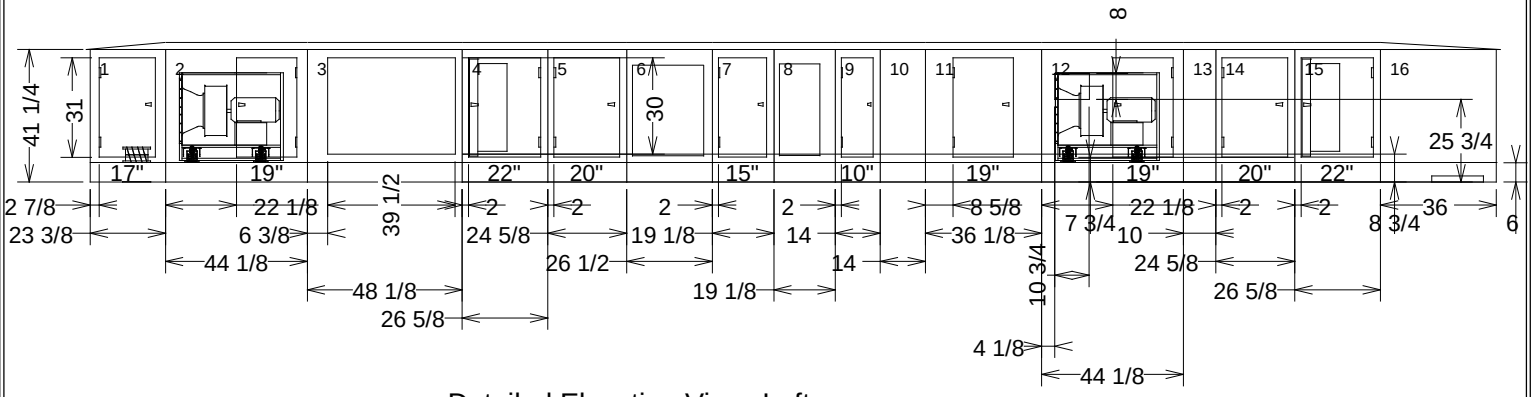
Detailed Plan View: Bottom - Measurements in inches

OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

Unit size: 8	Job Name: Miller Remick VA Lebanon Bldg 101 and Bldg 22	Unit Casing: 2in Double Wall	TRANE®
Product group: Outdoor unit	Actual airflow: 2700 cfm	Proposal Number:	
Integral base frame: 6in. integral base frame		Tags: AHU 101-3	*Performance Climate Changer™*
Paint: Factory painted - slate gray	Sales Office: Philadelphia Main Office	Rigging/Installed Weight: 5034.2 lb/ 5091.5 lb	*Air Handlers*



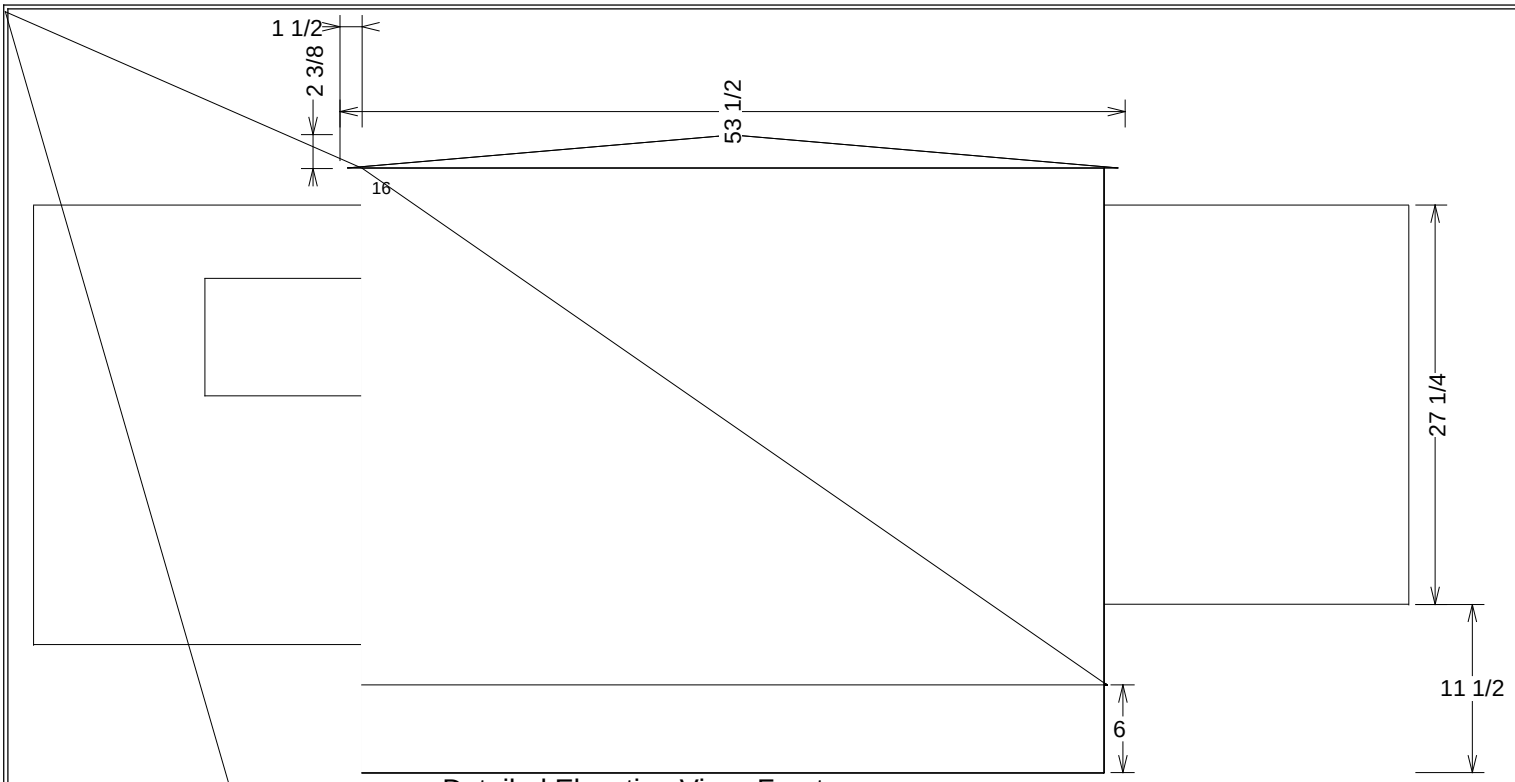
Detailed Elevation View: Right - Measurements in inches



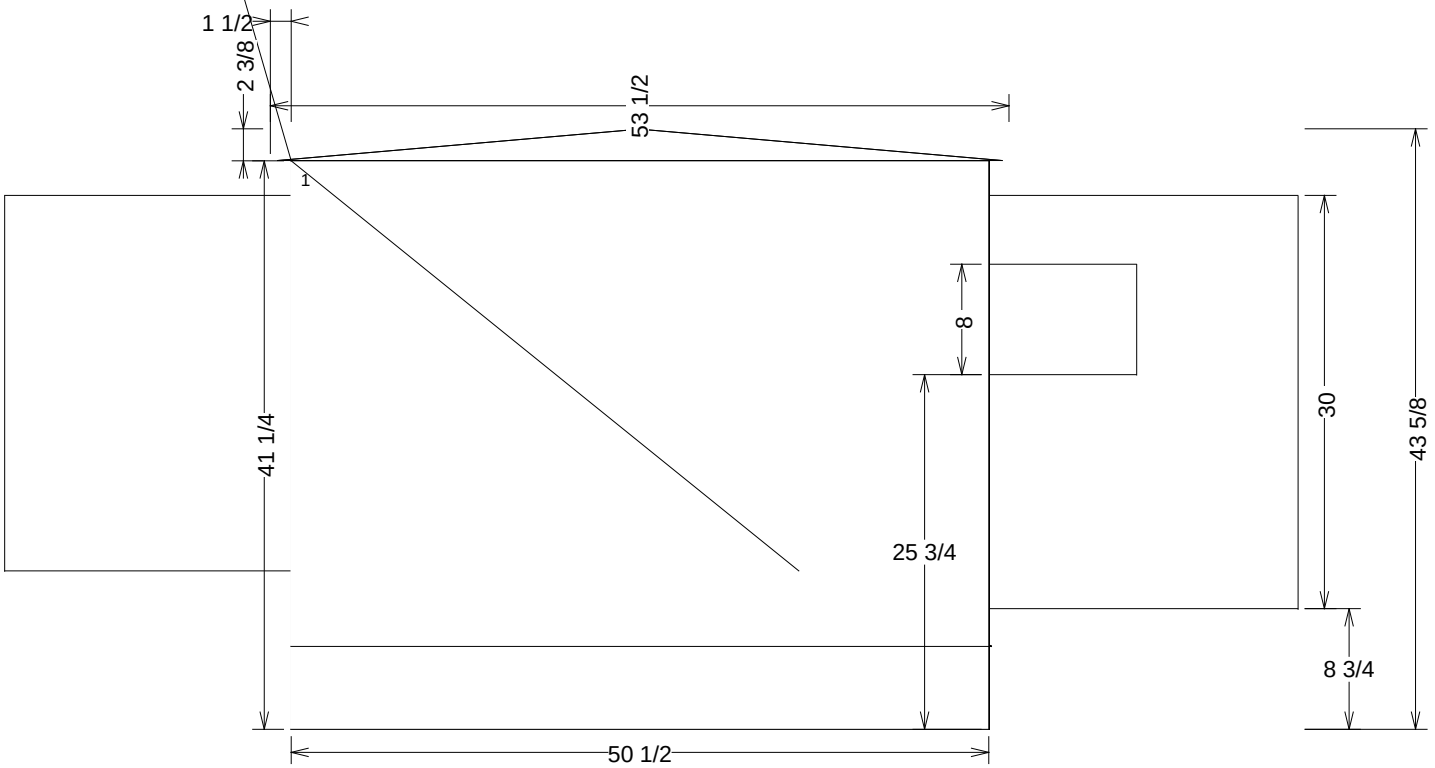
Detailed Elevation View: Left - Measurements in inches

OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

Unit size: 8	Job Name: Miller Remick VA Lebanon Bldg 101 and Bldg 22	Unit Casing: 2in Double Wall	TRANE®
Product group: Outdoor unit	Actual airflow: 2700 cfm	Proposal Number:	
Integral base frame: 6in. integral base frame		Tags: AHU 101-3	Performance Climate Changer™ Air Handlers
Paint: Factory painted - slate gray	Sales Office: Philadelphia Main Office	Rigging/Installed Weight: 5034.2 lb/ 5091.5 lb	



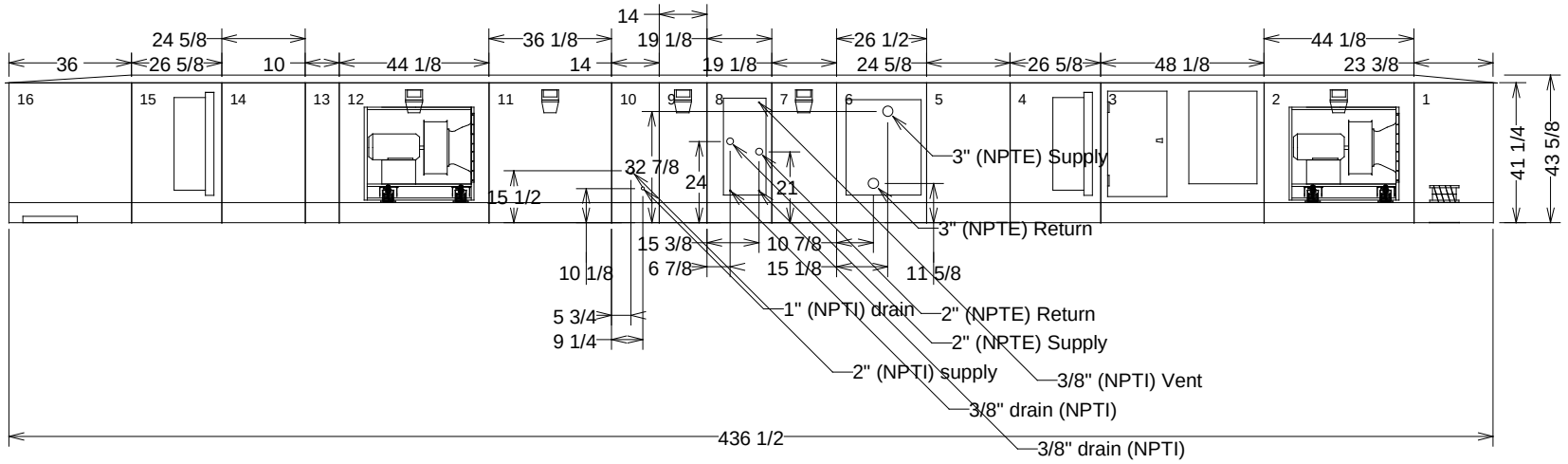
Detailed Elevation View: Front - Measurements in inches



Detailed Elevation View: Back - Measurements in inches

OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

Unit size: 8	Job Name: Miller Remick VA Lebanon Bldg 101 and Bldg 22	Unit Casing: 2in Double Wall	TRANE®
Product group: Outdoor unit	Actual airflow: 2700 cfm	Proposal Number:	Performance Climate Changer™ Air Handlers
Integral base frame: 6in. integral base frame		Tags: AHU 101-3	
Paint: Factory painted - slate gray	Sales Office: Philadelphia Main Office	Rigging/Installed Weight: 5034.2 lb/ 5091.5 lb	

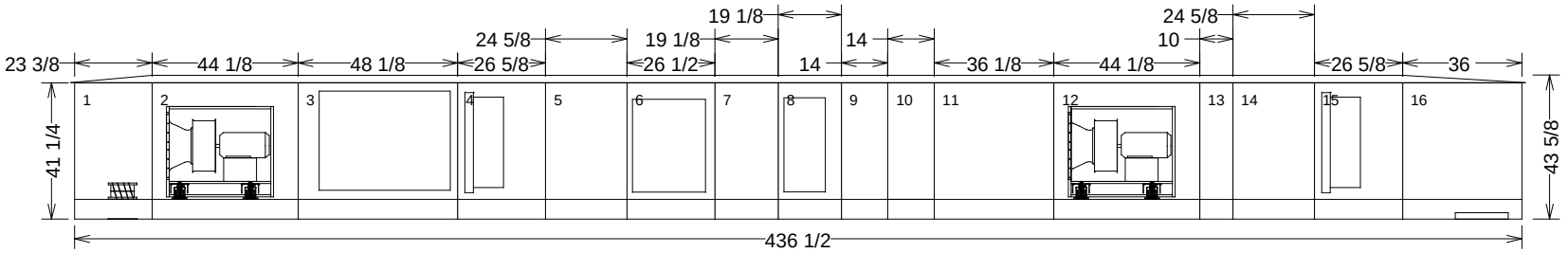


Coil connection view: Right - Measurements in inches

NPTI : National Pipe Thread Internal Connection
NPTE : National Pipe Thread External Connection

OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

Unit size: 8	Job Name: Miller Remick VA Lebanon Bldg 101 and Bldg 22	Unit Casing: 2in Double Wall	TRANE® Performance Climate Changer™ Air Handlers
Product group: Outdoor unit	Actual airflow: 2700 cfm	Proposal Number:	
Integral base frame: 6in. integral base frame		Tags: AHU 101-3	
Paint: Factory painted - slate gray	Sales Office: Philadelphia Main Office	Rigging/Installed Weight: 5034.2 lb/ 5091.5 lb	



Coil connection view: Left - Measurements in inches

NPTI : National Pipe Thread Internal Connection
NPTE : National Pipe Thread External Connection

OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

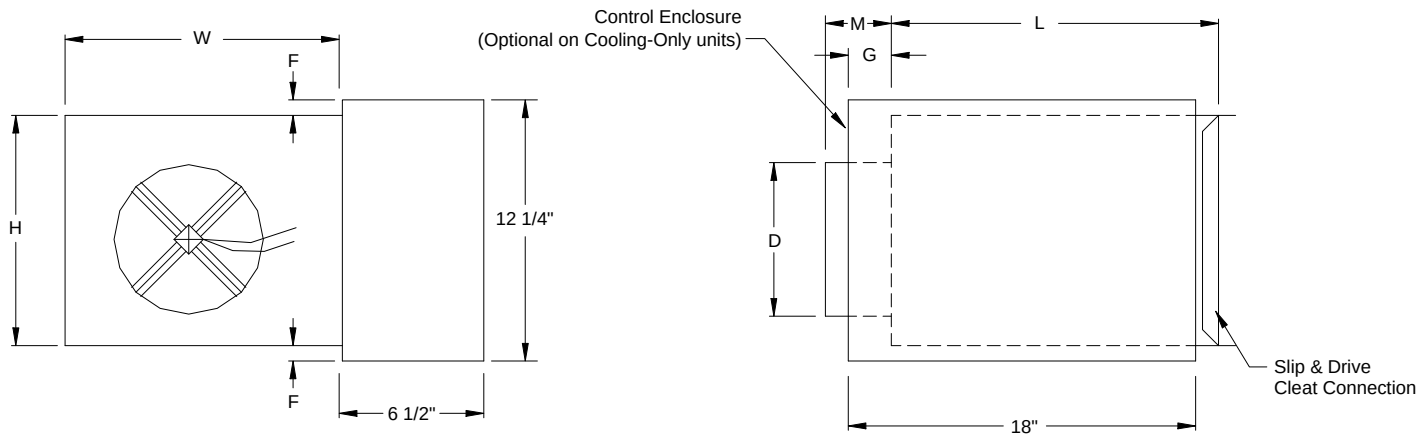
Unit size: 8	Job Name: Miller Remick VA Lebanon Bldg 101 and Bldg 22	Unit Casing: 2in Double Wall	TRANE® Performance Climate Changer™ Air Handlers
Product group: Outdoor unit	Actual airflow: 2700 cfm	Proposal Number:	
Integral base frame: 6in. integral base frame		Tags: AHU 101-3	
Paint: Factory painted - slate gray	Sales Office: Philadelphia Main Office	Rigging/Installed Weight: 5034.2 lb/ 5091.5 lb	

~~AESV~~ DESV

Single Duct Terminal Unit

~~Analog~~ Control, Pressure Independent

Digital



Right hand unit shown. All dimensions are in inches.

Inlet Size	CFM Range	D	F	G	H	L	M	W
4	0-225	3 7/8	2 1/8	7 3/8	8	15 1/2	5 3/8	12
5	0-350	4 7/8	2 1/8	7 3/8	8	15 1/2	5 3/8	12
6	0-500	5 7/8	2 1/8	7 3/8	8	15 1/2	3 3/8	12
7	0-650	6 7/8	1 1/8	7 3/8	10	15 1/2	3 3/8	12
8	0-900	7 7/8	1 1/8	7 3/8	10	15 1/2	3 3/8	12
9	0-1050	8 7/8	-	5 3/8	12 1/2	15 1/2	3 3/8	14
10	0-1400	9 7/8	-	5 3/8	12 1/2	15 1/2	3 3/8	14
12	0-2000	11 7/8	-	5 3/8	15	15 1/2	3 3/8	16
14	0-3000	13 7/8	-	3 3/8	17 1/2	15 1/2	3 3/8	20
16	0-4000	15 7/8	-	3 3/8	18	15 1/2	3 3/8	24
24 x 16	0-8000	23 7/8 x 15 7/8	1 1/8	5 3/8	18	15	3 3/8	38

Accessories (Optional)

Check ☑ if provided.

- ☐ 24 V Control Transformer
- ☐ Dust Tight Enclosure Seal
- ☐ Fibre Free Liner
- ☐ SteriLoc Liner
- ☐ UltraLoc Liner
- ☐ 1" Fiberglass Liner
- ☐ ½" EcoShield Liner
- ☐ 1" EcoShield Liner
- ☐ ½" EcoShield Liner (Foil Face)
- ☐ 1" EcoShield Liner (Foil Face)
- ☐ Disconnect Switch
- ☐ Hanger Brackets
- ☐ Removable Air Flow Sensor
- ☐ Bottom Access Door
- ☐ _____

General Description

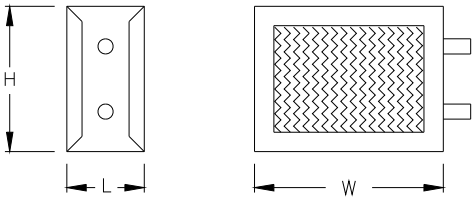
- Heavy gauge steel housing. Mechanically sealed and gasketed, leak resistant construction. Less than 2% of nominal cfm at 1.5" sp wg.
- Dual density internal insulation, treated to resist air erosion. Meets requirements of NFPA 90A and UL 181.
- Rectangular discharge opening is designed for slip and drive cleat duct connection.
- Multipoint center averaging inlet velocity sensor.
- Electronic proportional room thermostat with adjustable setpoints for temperature and airflow is included with unit.
- Minimum and maximum airflow adjustments are made at the thermostat, using a digital voltmeter.
- Choice of right hand or left hand control location.
- Electric damper actuator is an integral part of the unit.
- Model AESV can be installed horizontally, vertically, or at any angle. Operation is not affected by position.
- The control enclosure is optional and needs be ordered separately except for units with electric reheat.

Accessories (Optional)

☐ Hot Water Coil Section

- 1/2" copper tubes
- Aluminum ripple fins, 10 per inch
- Connections: Single circuit, 1/2" O.D. male solder. Multi-circuit, 7/8" O.D., male solder.
- Coil is installed at discharge of unit.
- On units with attenuators, coil are installed at the discharge of attenuator.

☐ 1 Row
☐ 2 Row
☐ 3 Row
☐ 4 Row



☐ Electric Coil Section ☐ Optional SCR Controlled Electric Heater

Standard Features

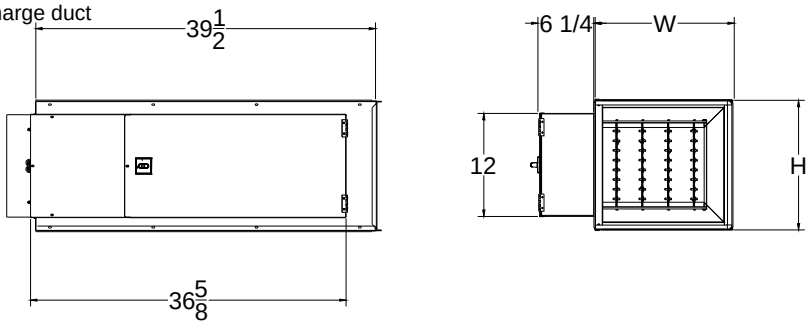
- Single side access to low voltage, high voltage, and electric heater controls.
- Automatic reset thermal cutouts, one per element
- Manual reset secondary protection.
- Positive pressure flow switch
- Magnetic contactor for each step.
- Slip and drive cleat discharge duct connection.

Options

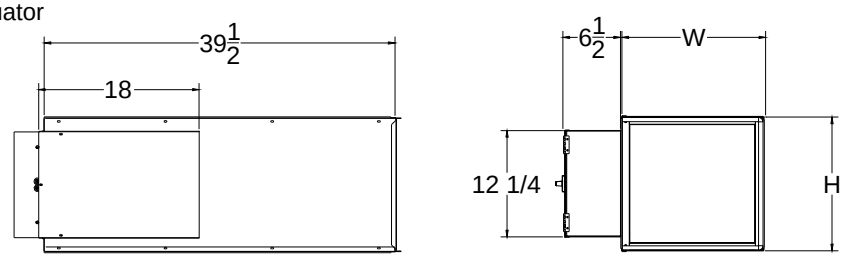
☐ Fuse Block
☐ Disconnect switch, door interlock type
☐ Dust tight construction
☐ Mercury contactors

Supply Voltage

☐ 208V, 1 ph, 60Hz
☐ 240V, 1 ph, 60Hz
☐ 277V, 1 ph, 60Hz
☐ 208V, 3 ph, 60Hz
☐ 480V, 3 ph, 60Hz (4 wire wye standard)



☐ Integral Sound Attenuator



Inlet Size	H	W	Water Coil	
			L (1-2 Row)	L (3-4 Row)
4	8	12	5	7 1/4
5	8	12	5	7 1/4
6	8	12	5	7 1/4
7	10	12	5	7 1/4
8	10	12	5	7 1/4
9	12 1/2	14	5	7 1/4
10	12 1/2	14	5	7 1/4
12	15	16	5	7 1/4
14	17 1/2	20	7 1/2	9 3/4
16	18	24	7 1/2	9 3/4
24 x 16	18	38	5	7 1/4

The total length of the AESV unit is the summation of the unit length (with or without attenuator) and the length of the optional water coil.

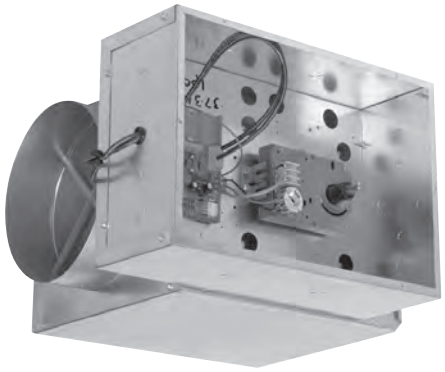
PERFORMANCE DATA

Single/Dual Duct Terminals

RECOMMENDED PRIMARY AIR CFM RANGES / ALL TERMINALS

Control Types:

PESV	**• Pneumatic**
AESV	**• Analog Electronic**
DESV	**• Digital Electronic**



AESV

QUICK SELECTION PROCEDURE

1. Select unit inlet size based upon acoustic parameters and/or maximum pressure drop requirements, using pages M13.
2. Check inlet size selection against cfm control limits based on control type shown on this page.
3. Select accessories (multi-outlets, attenuators) as required.
4. Select reheat coil, if required. Make your selection using the actual heating flow rate, not cooling.

Inlet Size	Total cfm Range	cfm Ranges of Minimum and Maximum Settings							
		PESV - Pneumatic Titus II Controller		PESV - Pneumatic Titus I Controller		AESV - Analog Electronic TA1 Controller		DESV - Digital Typical Controller	
		Minimum	Maximum	Minimum	Maximum	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
4	0-225	45*-170	80-225	55*-170	80-225	45*-225	45-225	45*-225	45-225
5	0-350	65*-270	120-350	85*-270	120-350	65*-350	65-350	65*-350	65-350
6	0-500	80*-330	150-500	105*-330	150-500	80*-500	80-500	80*-500	80-500
7	0-650	105*-425	190-650	135*-425	190-650	105*-650	105-650	105*-650	105-650
8	0-900	145*-590	265-900	190*-590	265-900	145*-900	145-900	145*-900	145-900
9	0-1050	175*-700	315-1050	225*-700	315-1050	175*-1050	175-1050	175*-1050	175-1050
10	0-1400	230*-925	415-1400	300*-925	415-1400	230*-1400	230-1400	230*-1400	230-1400
12	0-2000	325*-1330	600-2000	425*-1330	600-2000	325*-2000	325-2000	325*-2000	325-2000
14	0-3000	450*-1800	810-3000	575*-1800	810-3000	450*-3000	450-3000	450*-3000	450-3000
16	0-4000	580*-2350	1100-4000	750*-2350	1100-4000	580*-4000	580-4000	580*-4000	580-4000
24X16	0-8000	1400*-5200	2600-8000	1800*-5200	2600-8000	1400*-7500	1400-7500	1400*-7500	1400-7500

*Factory cfm settings (except zero) will not be made below this range because control accuracy is reduced. On pressure dependent units, minimum cfm is always zero and there is no maximum.

Note: On controls mounted by Titus but supplied by others (FMA or Factory Mounting Authorization), these values are guidelines only. Controls mounted on an FMA basis are calibrated in the field.

PESV, AESV, DESV / RADIATED SOUND PERFORMANCE

Size	CFM	Min ΔPs	Octave Band Sound Power, Lw																									
			0.5" ΔPs							1.0" ΔPs							1.5" ΔPs							2.0" ΔPs						
			2	3	4	5	6	7	NC	2	3	4	5	6	7	NC	2	3	4	5	6	7	NC	2	3	4	5	6	7	NC
4	100	0.02	49	45	36	33	31	26	11	52	48	39	36	35	31	15	53	50	41	37	37	34	17	55	51	43	38	39	36	18
	125	0.03	52	49	39	36	32	27	16	55	52	42	38	36	32	20	57	54	44	40	39	36	22	58	55	45	41	40	38	23
	150	0.04	55	52	41	37	34	28	20	58	55	44	40	38	34	23	60	57	46	41	40	37	25	61	58	47	42	42	39	27
	175	0.06	58	55	42	39	35	29	23	61	58	46	42	39	34	27	63	59	48	43	41	38	28	64	61	49	44	43	40	30
	200	0.08	60	57	44	40	36	30	25	63	60	47	43	40	35	29	65	62	49	44	42	38	31	66	63	51	45	44	41	33
5	150	0.01	49	44	36	32	31	25	10	53	49	41	36	35	30	16	55	51	43	38	37	33	18	57	53	45	39	39	35	21
	200	0.02	53	48	39	35	34	27	15	56	53	44	38	37	32	21	59	55	46	40	40	35	23	60	57	48	42	41	37	25
	250	0.03	55	52	41	37	35	29	20	59	56	46	40	39	34	24	62	59	49	42	41	37	28	63	61	51	44	43	39	30
	300	0.04	58	54	43	39	37	30	22	62	59	48	42	41	35	28	64	61	50	44	43	38	30	65	63	52	45	44	40	33
	350	0.06	60	56	45	40	38	31	24	63	61	49	43	42	36	30	66	63	52	45	44	39	33	67	65	54	47	45	41	35
6	300	0.07	55	49	40	35	32	28	16	59	54	45	39	37	33	22	61	57	48	41	39	36	25	63	59	50	42	41	38	28
	350	0.10	57	52	42	37	34	29	20	60	57	47	41	38	34	25	62	59	50	43	40	37	28	64	62	52	44	42	39	31
	400	0.13	58	53	44	39	35	30	21	61	58	49	42	39	35	27	63	61	52	44	42	38	30	65	63	54	46	43	40	33
	450	0.16	59	55	45	40	36	31	23	62	60	50	44	40	36	29	64	63	53	46	43	39	33	66	65	55	47	45	41	35
	500	0.20	59	56	47	42	37	32	24	63	61	51	45	41	37	30	65	64	54	47	44	40	34	67	67	56	49	46	42	37
7	450	0.07	59	48	42	38	33	24	20	61	54	48	42	38	30	23	62	57	51	45	41	33	25	63	59	53	46	43	35	28
	500	0.09	60	50	43	39	34	24	22	62	55	49	43	39	30	24	63	58	52	46	42	34	27	64	60	54	48	44	36	29
	550	0.10	60	51	44	40	35	25	22	63	57	50	45	40	31	25	64	59	53	47	43	34	28	66	62	55	49	45	37	31
	600	0.12	61	53	45	42	35	25	23	63	58	51	46	41	31	27	65	61	54	48	44	35	30	66	63	56	50	46	37	33
	650	0.15	62	54	46	43	36	26	24	64	59	52	47	41	32	28	65	62	55	49	44	35	31	66	64	57	51	46	38	34
8	600	0.02	59	50	44	40	38	32	20	62	55	49	43	43	39	24	64	58	52	46	45	44	27	65	60	54	47	47	47	29
	650	0.02	60	51	44	41	39	32	22	63	56	50	44	44	40	25	65	59	53	47	46	45	28	66	61	55	48	48	48	30
	700	0.02	60	52	45	42	40	33	22	63	57	50	45	44	41	25	65	60	53	47	47	45	29	67	62	56	49	49	48	31
	750	0.02	61	53	46	43	40	34	23	64	58	51	46	45	41	27	66	61	54	48	48	46	30	67	63	56	50	50	49	33
	800	0.03	62	54	47	43	41	34	24	65	59	52	47	46	42	28	66	62	55	49	48	47	31	68	64	57	51	50	50	34
9	800	0.04	58	47	43	36	34	30	19	61	53	49	42	40	35	23	62	57	52	46	44	38	26	63	59	55	48	47	40	29
	850	0.04	58	48	43	37	34	31	19	61	54	49	43	41	35	23	63	58	53	46	45	38	27	64	60	55	49	47	40	29
	900	0.05	59	49	44	37	35	31	20	62	55	50	43	41	35	24	64	58	53	47	45	38	27	65	61	56	49	48	40	30
	950	0.06	59	50	44	37	35	31	20	62	56	50	43	42	36	24	64	59	54	47	45	38	28	65	62	56	49	48	40	31
	1000	0.06	60	50	44	38	36	31	22	63	56	50	44	42	36	25	65	60	54	47	46	39	29	66	62	57	50	48	40	31
10	900	0.01	60	50	47	45	42	29	22	63	57	53	50	48	37	27	65	60	57	53	52	41	31	67	63	59	56	54	44	34
	1000	0.01	60	51	48	46	43	30	22	64	58	54	51	49	38	28	66	61	57	54	53	42	31	67	64	59	56	55	45	34
	1100	0.01	61	52	48	47	44	32	23	65	58	54	52	50	39	28	67	62	57	55	54	43	31	68	64	60	57	56	46	35
	1200	0.01	62	53	48	47	45	32	24	65	59	54	53	51	40	28	67	63	58	56	55	44	33	69	65	60	58	57	47	35
	1300	0.01	63	54	49	48	45	33	25	66	60	55	53	52	41	29	68	63	58	56	55	45	33	69	66	61	58	58	48	36
12	1200	0.01	58	50	47	41	37	30	20	62	56	52	47	43	37	26	64	59	56	50	46	41	30	66	61	58	53	49	43	32
	1400	0.01	60	52	48	42	38	32	22	63	57	54	48	45	39	28	65	60	57	52	48	42	31	67	63	60	54	51	45	35
	1600	0.01	61	53	50	43	40	34	24	64	59	55	49	46	40	29	66	62	59	53	50	44	34	68	64	61	55	52	47	36
	1800	0.01	61	55	51	44	41	35	25	65	60	56	50	48	41	30	67	63	60	54	51	45	35	69	65	62	56	54	48	37
	2000	0.01	62	56	52	45	43	36	26	66	61	57	51	49	43	31	68	64	61	55	52	47	36	69	67	63	57	55	49	38
14	1500	0.02	56	51	45	43	40	36	18	60	56	50	48	45	41	24	62	59	53	51	48	45	28	64	61	55	53	50	47	30
	1800	0.03	58	53	46	44	41	36	21	62	58	51	49	46	42	27	64	60	54	52	49	45	29	66	63	56	54	51	48	33
	2100	0.04	59	54	47	45	42	37	22	63	59	52	50	47	43	28	66	62	55	53	50	46	31	67	64	58	55	52	49	34
	2400	0.05	60	55	48	46	43	38	23	64	60	53	51	48	43	29	67	63	56	54	51	47	33	69	65	58	56	53	49	35
	2700	0.06	62	56	49	47	44	38	24	66	61	54	52	49	44	30	68	64	57	55	52	47	34	70	66	59	57	54	50	36
16	2000	0.02	55	48	43	41	39	31	36	59	53	47	45	44	38	21	61	56	50	47	47	41	24	63	58	52	49	49	44	27
	2400	0.02	57	51	45	43	41	33	18	61	56	49	47	46	39	24	64	59	52	49	49	43	28	65	61	54	51	51	46	30
	2800	0.03	59	53	46	44	42	34	21	63	58	51	48	47	41	27	66	61	54	50	50	45	30	67	63	55	52	52	48	33
	3200	0.04	61	55	48	46	44	36	23	65	60	52	50	49	42	29	67	62	55	52	52	46	31	69	64	57	53	54	49	34
	3600	0.05	62	56	49	47	45	37	24	66	61	54	51	50	44	30	69	64	56	53	53	48	34	71	66	58	55	55	50	36
40	3900	0.03	70	65	63	59	57	54	38	72	68	66	62	61	58	41	74	69	67	63	63	61	42	75	70	68	64	65	63	43
	4600	0.04	73	68	66	62	59	55	41	75	71	68	64	63	60	43	77	72	70	66	65	63	46	78	73	71	67	67	64	47
	5300	0.06	75	71	68	64	61	56	43	78	73	71	66	65	61	47	79	74	72	68	67	64	48	80	75	73	69	68	66	49
	6000	0.07	77	73	71	66	63	57	47	80	75	73	68	66	62	49	81	76	74	70	68	65	50	82	77	75	71	70	67	51
	6700	0.09	79	75	72	67	64	58	48	82	77	75	70	68	63	51	83	78	76	71	70	66	52	84	79	77	72	71	68	53

- Radiated sound is the noise transmitted through the unit casing.
- Min ΔPs is the static pressure drop from the unit inlet to the unit outlet with primary damper full open.
- Sound power levels are in dB, ref 10^{-12} watts.
- Sound performance based on units lined with standard dual density fiberglass lining.
- All performance based on tests conducted in accordance with ASHRAE 130-2008 and AHRI 880-2008.
- All NC levels determined using AHRI 885-2008 Appendix E. See Terminal Unit Engineering Guidelines.
- Dash (-) in space denotes NC value less than NC10.
- Only highlighted data points are AHRI certified. See page M24 for AHRI Certified Performance Listings.

PESV, AESV, DESV / DISCHARGE SOUND PERFORMANCE

Size	CFM	Min ΔPs	Octave Band Sound Power, Lw																									
			0.5" ΔPs							1.0" ΔPs							1.5" ΔPs							2.0" ΔPs						
			2	3	4	5	6	7	NC	2	3	4	5	6	7	NC	2	3	4	5	6	7	NC	2	3	4	5	6	7	NC
4	100	0.02	62	53	46	42	40	33	17	63	56	50	46	47	41	18	64	58	53	49	50	46	19	65	59	55	51	53	49	20
	125	0.03	64	57	49	44	42	35	19	65	60	53	49	49	43	20	66	61	56	52	52	47	22	67	62	58	54	55	51	23
	150	0.04	65	60	51	47	44	36	20	67	62	56	51	50	44	23	68	64	59	54	54	49	24	68	65	60	56	57	52	24
	175	0.06	67	62	53	48	45	37	23	68	65	58	53	51	45	24	69	66	61	56	55	50	25	70	68	63	58	58	53	28
	200	0.08	68	64	55	50	46	38	24	69	67	60	55	53	46	27	70	69	62	58	56	51	29	71	70	64	60	59	54	30
5	150	0.01	60	50	46	43	41	34	14	62	55	51	47	47	42	17	64	57	54	50	51	46	19	65	59	57	52	53	49	20
	200	0.02	63	54	49	46	43	36	18	65	58	55	51	49	44	20	67	61	58	53	53	48	23	68	63	60	55	55	51	24
	250	0.03	65	57	52	49	45	38	20	67	62	57	53	51	45	23	69	64	60	56	55	50	25	70	66	62	58	57	53	27
	300	0.04	66	59	54	51	47	39	18	69	64	59	55	53	46	22	70	67	62	58	56	51	25	71	69	65	60	59	54	28
	350	0.06	68	61	56	52	48	40	20	70	66	61	57	54	47	24	72	69	64	60	57	52	28	73	71	66	61	60	55	30
6	300	0.07	60	57	53	50	45	39	14	64	62	58	54	51	46	20	67	65	61	57	54	50	23	69	67	63	58	56	53	25
	350	0.10	61	59	54	52	47	40	16	66	64	60	56	52	47	22	68	67	63	59	55	51	25	70	69	65	60	58	54	28
	400	0.13	63	60	56	54	48	41	17	67	66	61	58	53	48	24	70	69	64	60	57	52	28	71	71	66	62	59	55	30
	450	0.16	64	62	57	55	49	42	20	68	67	63	59	54	49	25	71	70	66	62	58	53	29	73	73	68	63	60	56	33
	500	0.20	65	63	59	56	50	43	21	69	69	64	61	55	50	28	72	72	67	63	59	54	31	74	74	69	65	61	57	34
7	450	0.07	64	58	53	51	47	40	15	67	63	58	54	51	46	21	68	67	60	56	54	49	25	70	69	62	58	56	52	28
	500	0.09	64	59	54	52	48	40	16	67	65	59	56	52	47	23	69	68	62	58	55	50	27	70	71	63	59	57	53	30
	550	0.1	65	61	55	54	49	41	18	68	66	60	57	53	48	24	69	70	63	59	56	51	29	71	72	64	60	58	54	31
	600	0.12	65	62	56	55	49	42	20	68	67	61	58	54	48	25	70	71	63	60	57	52	30	71	73	65	61	59	55	33
	650	0.15	65	63	57	56	50	43	21	68	69	62	59	55	49	28	70	72	64	61	58	53	31	72	74	66	62	59	55	34
8	600	0.02	66	60	55	52	48	40	18	69	66	59	55	52	47	24	71	69	61	56	55	51	28	72	72	63	57	57	54	31
	650	0.02	67	61	56	53	48	41	19	70	67	60	56	53	47	25	71	70	62	57	55	51	29	72	73	64	58	57	54	33
	700	0.02	67	62	56	54	49	41	20	70	68	60	56	53	48	27	72	71	63	58	56	52	30	73	74	64	59	58	55	34
	750	0.02	68	63	57	54	49	42	20	70	69	61	57	54	48	27	72	72	63	58	56	52	30	73	75	65	60	58	55	34
	800	0.03	68	64	57	55	50	42	21	71	70	62	58	54	49	28	72	73	64	59	57	53	31	74	75	66	60	59	56	34
9	800	0.04	67	59	56	53	49	43	17	70	64	60	57	54	49	21	71	67	62	59	57	53	24	72	69	64	60	59	56	27
	850	0.04	68	60	56	53	49	43	18	70	65	60	57	54	50	22	72	68	62	59	57	54	25	73	70	64	61	59	56	28
	900	0.05	68	61	57	54	50	43	18	71	66	61	57	55	50	23	73	68	63	59	57	54	25	74	70	65	61	59	57	28
	950	0.06	69	61	57	54	50	44	19	72	66	61	58	55	50	23	73	69	63	60	58	54	27	74	71	65	61	60	57	29
	1000	0.06	69	62	58	55	50	44	19	72	67	61	58	55	50	24	74	70	64	60	58	54	28	75	72	65	62	60	57	30
10	900	0.01	69	60	57	55	50	44	19	71	65	61	59	55	50	22	72	68	64	61	58	54	25	73	71	66	63	61	57	29
	1000	0.01	70	61	58	56	50	44	20	72	66	62	60	56	51	23	73	69	65	62	59	55	27	74	72	67	64	61	57	30
	1100	0.01	70	61	58	57	51	45	20	73	67	63	61	56	51	24	74	70	65	63	60	55	28	75	72	67	65	62	58	30
	1200	0.01	71	62	59	57	52	45	22	73	68	63	61	57	52	25	75	71	66	64	60	56	29	76	73	68	66	63	59	31
	1300	0.01	72	63	60	58	52	46	23	74	68	64	62	58	53	25	75	72	67	65	61	56	30	76	74	68	66	63	59	33
12	1200	0.01	68	62	59	55	53	46	18	71	67	63	59	57	52	24	73	70	65	62	60	56	28	74	72	67	64	62	59	30
	1400	0.01	69	63	61	56	54	47	20	72	69	65	61	59	53	27	74	72	67	63	61	57	30	75	74	69	65	63	60	33
	1600	0.01	70	64	62	57	55	48	21	73	70	66	62	59	55	28	75	73	68	64	62	58	31	76	75	70	66	64	61	34
	1800	0.01	71	66	63	58	55	49	23	74	71	67	63	60	56	29	75	74	70	65	63	59	33	76	76	71	67	65	62	35
	2000	0.01	71	67	64	59	56	50	24	74	72	68	64	61	56	30	76	75	71	66	64	60	34	77	77	72	68	66	63	36
14	1500	0.02	65	56	56	53	50	44	14	68	62	61	59	57	53	18	70	66	63	62	62	59	23	72	68	65	65	65	62	25
	1800	0.03	66	58	58	53	50	44	15	69	64	62	59	58	53	21	71	67	65	63	62	59	24	73	70	67	65	65	63	28
	2100	0.04	67	59	59	54	51	44	17	70	65	64	60	58	54	22	72	68	66	63	63	59	25	74	71	68	66	66	63	29
	2400	0.05	68	60	60	54	51	44	18	71	66	65	60	59	54	23	73	69	68	64	63	59	27	74	72	69	66	66	63	30
	2700	0.06	68	61	61	54	51	45	18	72	67	66	61	59	54	24	74	70	69	64	63	60	28	75	73	70	67	66	63	31
16	2000	0.02	65	58	57	54	52	45	14	68	62	60	58	56	51	18	70	65	62	61	59	54	22	71	67	63	63	61	57	24
	2400	0.02	67	61	59	55	53	46	17	70	65	63	60	58	52	22	72	67	64	62	61	56	24	73	69	66	64	62	58	27
	2800	0.03	68	63	61	57	55	48	20	72	67	65	61	59	54	24	74	69	66	64	62	57	27	75	71	68	66	64	60	29
	3200	0.04	70	64	63	58	56	49	21	73	68	66	62	60	55	25	75	71	68	65	63	59	29	76	72	70	67	65	61	30
	3600	0.05	71	66	65	59	57	50	23	74	70	68	63	61	56	28	76	72	70	66	64	60	30	78	74	71	68	66	62	33
40	3900	0.03	74	69	66	62	61	56	27	79	74	71	67	67	62	33	82	77	74	69	70	66	36	84	79	76	71	72	68	34
	4600	0.04	75	70	67	63	63	58	28	80	76	73	68	68	64	35	83	79	76	71	71	67	38	86	81	78	73	74	70	41
	5300	0.06	77	72	69	65	64	60	30	82	77	74	69	70	65	36	85	80	77	72	73	69	40	87	82	79	74	75	71	42
	6000	0.07	78	73	70	66	65	61	31	83	78	75	71	71	67	37	86	81	78	73	74	70	41	88	83	80	75	76	73	43
	6700	0.09	79	74	71	67	67	62	33	84	79	76	72	72	68	38	87	82	79	74	75	71	42	89	84	81	76	77	74	45

- Discharge sound is the noise emitted from the unit discharge into the downstream ductwork.
- Min ΔPs is the static pressure drop from the unit inlet to the unit outlet with primary damper full open.
- Sound power levels are in dB, ref 10^{-12} watts.
- Sound performance based on units lined with standard dual density fiberglass lining.
- All performance based on tests conducted in accordance with ASHRAE 130-2008 and AHRI 880-2008.
- All NC levels determined using AHRI 885-2008 Appendix E. See Terminal Unit Engineering Guidelines.
- Dash (-) in space denotes NC value less than NC10.
- Only highlighted data points are AHRI certified. See page M24 for AHRI Certified Performance Listings.

PESV, AESV, DESV / HOT WATER COIL CAPACITY, MBH / 3- AND 4-ROW

	Rows/ Circuits	gpm	Head Loss	Airflow, cfm								
Sizes 4-5-6				50	100	150	200	250	300	350	400	450
	Three-Row Multi-Circuit	2.0	1.31	6.2	11.0	14.9	18.1	20.9	23.3	25.4	27.3	28.9
		3.0	2.63	6.2	11.2	15.3	18.8	21.9	24.5	26.9	29.1	31.0
		5.0	6.43	6.3	11.4	15.7	19.4	22.7	25.6	28.3	30.7	32.9
		6.0	8.88	6.3	11.4	15.8	19.6	22.9	25.9	28.7	31.2	33.5
		Airside ΔPs		0.01	0.03	0.06	0.10	0.14	0.20	0.26	0.33	0.40
	Four-Row Multi-Circuit	3.0	1.59	6.5	12.1	16.9	21.1	24.7	27.9	30.7	33.3	35.6
		4.0	2.61	6.5	12.2	17.2	21.5	25.3	28.7	31.8	34.6	37.2
		6.0	5.28	6.5	12.3	17.4	21.9	26.0	29.6	33.0	36.0	38.8
		8.0	8.77	6.5	12.4	17.5	22.2	26.3	30.1	33.6	36.8	39.8
		Airside ΔPs		0.01	0.04	0.08	0.13	0.19	0.26	0.34	0.43	0.53
Sizes 7-8	Rows/ Circuits	gpm	Head Loss	Airflow, cfm								
				100	200	300	400	500	600	700	800	900
	Three-Row Multi-Circuit	2.0	0.79	11.5	19.2	24.8	29.2	32.7	35.6	38.1	40.2	42.0
		4.0	2.63	11.8	20.3	27.0	32.5	37.0	41.0	44.4	47.4	50.1
		6.0	5.31	11.9	20.8	27.9	33.7	38.8	43.2	47.0	50.5	53.6
		8.0	8.80	11.9	21.0	28.3	34.4	39.7	44.4	48.5	52.2	55.6
		Airside ΔPs		0.02	0.06	0.12	0.20	0.29	0.40	0.53	0.67	0.83
	Four-Row Multi-Circuit	4.0	2.04	12.6	22.6	30.6	37.2	42.7	47.5	51.7	55.3	58.6
		6.0	4.12	12.7	23.0	31.5	38.7	44.9	50.3	55.0	59.3	63.2
		8.0	6.79	12.7	23.2	32.0	39.5	46.0	51.8	56.9	61.6	65.8
		10.0	10.04	12.7	23.4	32.3	40.0	46.8	52.8	58.1	63.0	67.5
		Airside ΔPs		0.02	0.08	0.16	0.26	0.39	0.53	0.70	0.89	1.10
Sizes 9-10	Rows/ Circuits	gpm	Head Loss	Airflow, cfm								
				200	300	400	500	600	700	800	900	1000
	Three-Row Multi-Circuit	3.0	1.18	21.5	28.8	34.7	39.7	43.9	47.5	50.8	53.6	56.2
		5.0	2.85	22.1	30.1	36.8	42.5	47.6	52.0	56.0	59.6	62.9
		7.0	5.11	22.4	30.7	37.8	43.9	49.4	54.3	58.7	62.7	66.4
		9.0	7.92	22.6	31.1	38.3	44.7	50.4	55.6	60.3	64.5	68.5
		Airside ΔPs		0.03	0.06	0.10	0.15	0.21	0.27	0.34	0.42	0.51
	Four-Row Multi-Circuit	4.0	1.72	23.9	33.0	40.7	47.3	53.0	58.0	62.5	66.5	70.1
		5.0	2.53	24.1	33.5	41.6	48.6	54.7	60.2	65.1	69.5	73.5
		8.0	5.71	24.4	34.3	43.0	50.6	57.5	63.7	69.4	74.5	79.3
		10.0	8.41	24.6	34.6	43.5	51.4	58.5	65.0	70.9	76.4	81.5
		Airside ΔPs		0.04	0.08	0.13	0.20	0.27	0.36	0.46	0.56	0.68
Size 12	Rows/ Circuits	gpm	Head Loss	Airflow, cfm								
				300	500	700	900	1100	1300	1500	1700	1900
	Three-Row Multi-Circuit	3.0	1.50	29.7	40.6	48.3	53.9	58.4	61.9	64.8	67.3	69.4
		4.0	2.46	31.9	45.6	56.2	64.6	71.6	77.4	82.5	86.8	90.7
		6.0	4.94	32.6	47.5	59.3	69.0	77.2	84.3	90.5	95.9	100.8
		8.0	8.14	33.0	48.5	61.0	71.4	80.4	88.2	95.0	101.2	106.7
		Airside ΔPs		0.03	0.09	0.16	0.24	0.35	0.47	0.60	0.75	0.91
	Four-Row Multi-Circuit	4.5	2.67	35.2	52.0	65.3	76.0	84.9	92.4	98.8	104.4	109.4
		5.0	3.20	35.4	52.6	66.2	77.4	86.7	94.7	101.5	107.5	112.8
		7.0	5.71	36.1	54.5	69.7	82.5	93.5	103.2	111.7	119.3	126.1
		9.0	8.81	36.3	55.1	70.9	84.3	96.0	106.3	115.5	123.7	131.2
		Airside ΔPs		0.05	0.11	0.21	0.32	0.46	0.61	0.79	0.99	1.20

For Performance Notes, see the next page.

PESV, AESV, DESV / HOT WATER COIL CAPACITY, MBH / 3- AND 4-ROW

	Rows/ Circuits	gpm	Head Loss	Airflow, cfm								
Size 14				400	700	1000	1300	1600	1900	2200	2500	2800
	Three-Row Multi-Circuit	4.0	1.95	42.5	62.2	76.5	87.5	96.3	103.5	109.5	114.7	119.1
		5.0	2.87	43.2	64.2	79.9	92.2	102.2	110.5	117.6	123.7	129.0
		6.0	3.93	43.7	65.6	82.2	95.5	106.4	115.6	123.5	130.4	136.5
		8.0	6.44	44.4	67.3	85.3	99.9	112.2	122.7	131.8	139.9	147.0
		Airside ΔPs		0.03	0.08	0.15	0.24	0.34	0.46	0.60	0.75	0.92
	Four-Row Multi-Circuit	6.0	2.77	47.6	73.2	93.0	108.8	121.8	132.6	141.8	149.7	156.7
		6.0	2.77	47.6	73.2	93.0	108.8	121.8	132.6	141.8	149.7	156.7
		8.0	4.55	48.2	75.2	96.7	114.3	129.1	141.7	152.6	162.1	170.5
		10.0	6.67	48.6	76.4	99.0	117.9	133.9	147.7	159.7	170.4	180.0
		Airside ΔPs		0.04	0.10	0.20	0.31	0.45	0.61	0.79	1.00	1.22
	Rows/ Circuits	gpm	Head Loss	Airflow, cfm								
Size 16				600	1000	1400	1800	2200	2600	3000	3400	3800
	Three-Row Multi-Circuit	6.0	1.54	60.4	84.3	101.8	115.5	126.4	135.5	143.1	149.7	155.5
		8.0	2.54	61.9	87.8	107.4	123.0	135.9	146.7	155.9	164.0	171.0
		10.0	3.73	62.9	90.0	111.1	128.1	142.2	154.3	164.7	173.8	182.0
		12.0	5.10	63.5	91.6	113.7	131.7	146.8	159.8	171.1	181.1	190.0
		Airside ΔPs		0.04	0.11	0.20	0.31	0.44	0.59	0.76	0.94	1.15
	Four-Row Multi-Circuit	9.0	2.79	68.9	100.8	125.6	145.5	161.9	175.8	187.7	198.0	207.0
		10.0	3.34	69.3	101.9	127.5	148.3	165.6	180.2	192.8	203.9	213.6
		11.0	3.94	69.7	102.9	129.2	150.7	168.6	184.0	197.3	208.9	219.2
		12.0	4.57	69.9	103.6	130.5	152.7	171.3	187.2	201.1	213.3	224.2
		Airside ΔPs		0.06	0.14	0.26	0.40	0.58	0.78	1.00	1.25	1.52
	Rows/ Circuits	gpm	Head Loss	Airflow, cfm								
Size 24 x 16				600	1200	1800	2400	3000	3600	4200	4800	5400
	Three-Row Multi-Circuit	6.0	1.69	66.6	107.8	135.8	156.2	171.9	184.4	194.6	203.2	210.4
		8.0	2.78	67.9	112.5	144.3	168.4	187.5	203.0	216.0	227.0	236.6
		10.0	4.08	68.7	115.4	149.8	176.4	197.9	215.7	230.8	243.8	255.1
		12.0	5.57	69.3	117.4	153.6	182.1	205.4	225.0	241.7	256.2	269.0
		Airside ΔPs		0.02	0.07	0.14	0.23	0.33	0.46	0.61	0.77	0.95
	Four-Row Multi-Circuit	9.0	3.01	73.7	127.6	167.4	198.0	222.2	242.0	258.4	272.3	284.3
		10.0	3.61	74.0	129.0	170.3	202.4	228.2	249.4	267.2	282.4	295.5
		11.0	4.25	74.3	130.2	172.7	206.1	233.2	255.7	274.7	291.0	305.1
		12.0	4.93	74.5	131.1	174.7	209.3	237.6	261.2	281.2	298.5	313.6
		Airside ΔPs		0.03	0.09	0.18	0.30	0.44	0.61	0.80	1.02	1.25

- All coil performance in accordance with AHRI 410-2001.
- Heating capacities are in MBH.
- Data based on 180°F entering water and 55°F entering air.
- For temperature differentials other than 125°, multiply MBH by correction factors below.
- Head loss is in feet of water.
- Always supply water to lowest connection pipe to prevent air entrapment.
- Air temperature rise = 927 x MBH/cfm.
- Water temperature drop = 2.04 x MBH/gpm.
- Connection size is ½-in OD male solder for 1-row coil sizes 04-08. All other coils have ⅞-in OD male solder.
- Coils are not intended for steam applications and are labeled for a maximum water temperature of 200°F.
- Coils are tested for leakage at test pressure of 500 psi.
- Water volumes less than those shown may result in laminar flow and reduced heating capacity. If possible reduce the number of coil rows to increase water velocity into turbulent range.

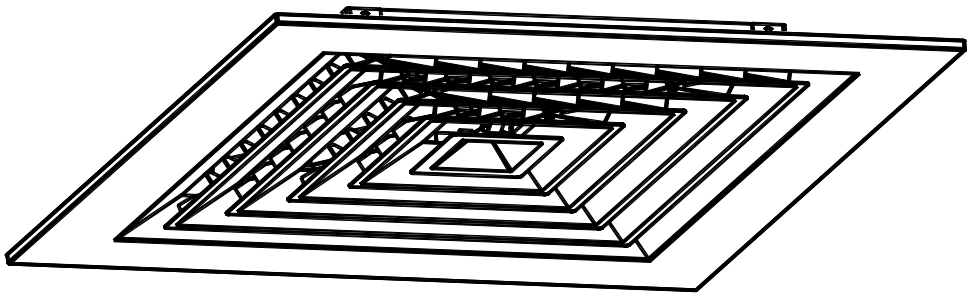
Correction Factors for Other Entering Conditions

Δ T	50	60	70	80	90	100	110	125	140	150
Factor	0.40	0.48	0.56	0.64	0.72	0.80	0.88	1.00	1.12	1.20

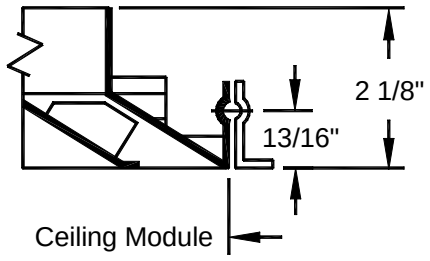
Note: Airside DPs reflects the air pressure drop of the hot water coil.

Square and Rectangular Ceiling Diffusers
Steel • Louvered Face • Induction Vanes

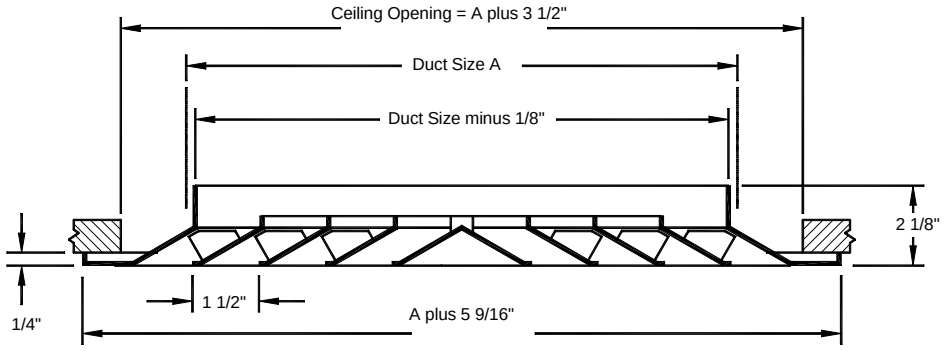
Model: TDV • Square, Rectangle or Round Neck



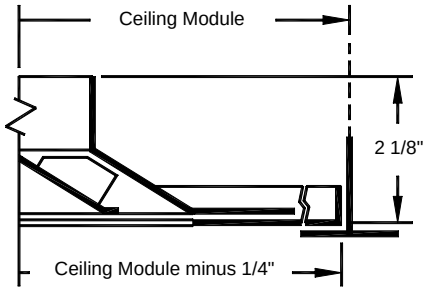
☐ **Border Type 2 (Snap-In)**



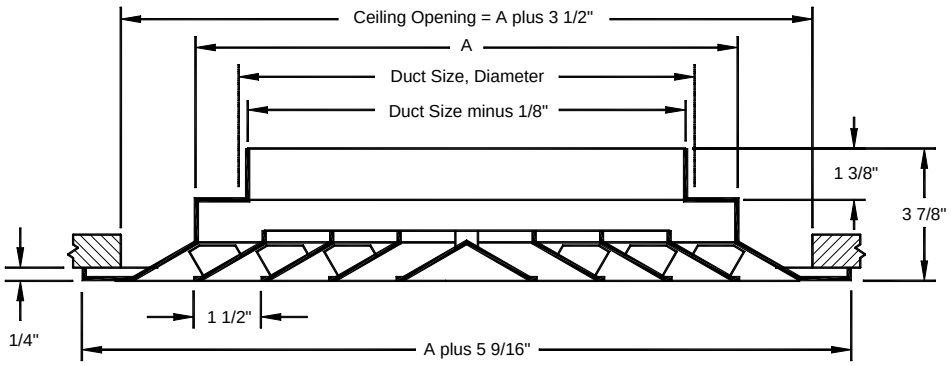
☐ **Border Type 1 (Surface Mount) Square or Rectangular Neck**



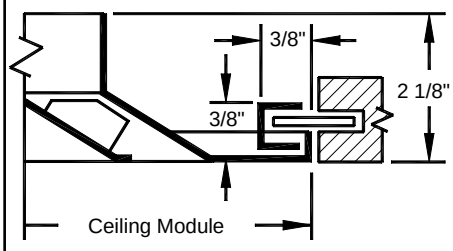
☐ **Border Type 3 (Lay-In)**



☐ **Border Type 1 (Surface Mount) Round Neck**



☐ **Border Type 4 (Spline)**



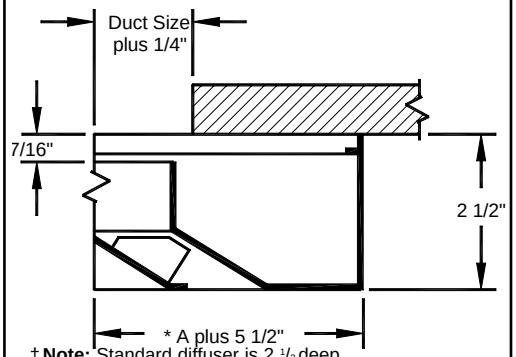
Dimensions are in inches.

For Dimensions "A" see table on next page.

(Please see reverse side).

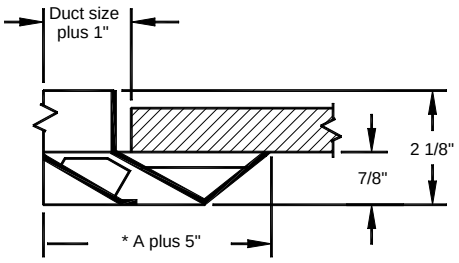
Border Types, Dimensions (Continued)

Border Type 5 (Dropped Face)



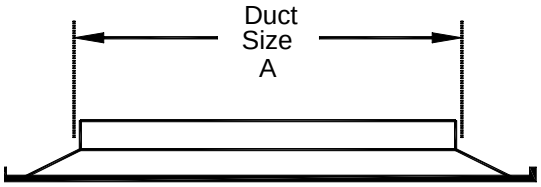
† **Note:** Standard diffuser is 2 ½ deep.
Optional 4" deep diffuser is available.

Border Type 6 (Beveled Drop Face)



***Note:** Dimension A refers to either square/rectangle or round neck diffusers. See drawings below.

Available Duct Sizes, Square and Rectangular Necks

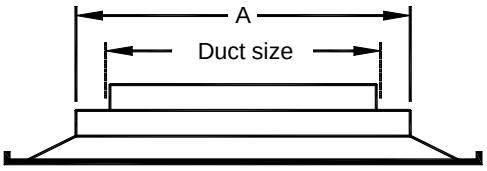


Border Type 1, 5, 6	
Minimum Duct Size A	**Maximum Duct Size A**
6 x 6	48 x 48

Border Type 2, 3, 4		
Available Module Size	**Minimum Duct Size A**	**Maximum Duct Size A**
12 x 12	6 x 6	9 x 9
24 x 24	6 x 6	18 x 18
48 x 24	12 x 12	42 x 18

Note: Duct sizes are available in 3" increments only.
Maximum duct size for border 5 is 36 x 36.

Available Duct Sizes, Round Necks



Border Type 1, 5, 6	
Dimensions A	**Available Round Duct Size**
6 x 6	6
9 x 9	6, 8
12 x 12	8, 10, 12
15 x 15	6, 8, 10, 12, 14
18 x 18	6, 8, 10, 12, 14, 16

Border Type 2,3,4		
Available Module Size	**Minimum A**	**Available Round Duct Size**
12 x 12	6 x 6	6
	9 x 9	6, 8
24 x 24	6 x 6	6
	9 x 9	6, 8
	12 x 12	6, 8, 10, 12
	15 x 15	6, 8, 10, 12, 14
	18 x 18	6, 8, 10, 12 14, 16

***Note:** Round duct sizes are available only in sizes shown.

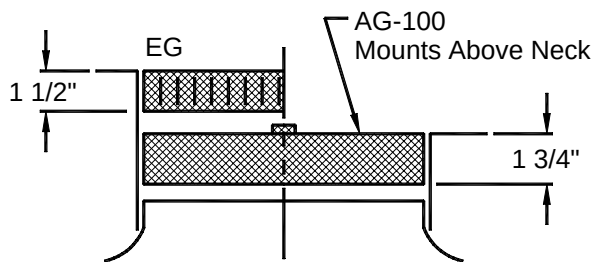
† **See Page 3**

Accessories (Optional) for Round Neck

Check ☐ if provided

☐ **Model AG-100 Radial Sliding Blade Damper ***

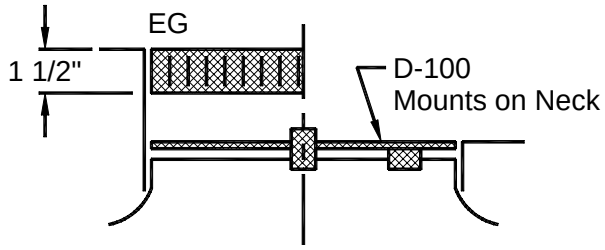
☐ **Model EG Equalizing Grid**



Model AG-100 damper is available in duct sizes 6 thru 14 inches only

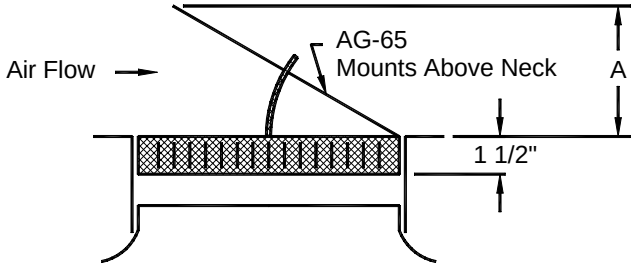
☐ **Model D-100 Radial Sliding Blade Damper ***

☐ **Model EG Equalizing Grid**



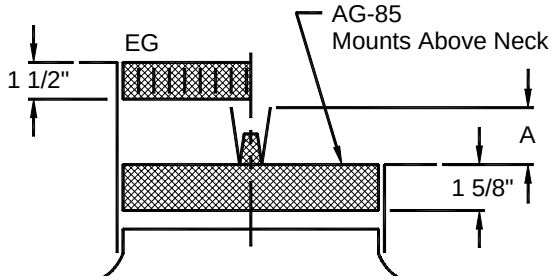
Model D-100 damper is available in duct sizes 6 thru 14 inches only.

☐ **Model AG-65 Combination Damper and Equalizing Grid ***



☐ **Model AG-85 Butterfly Damper ***

☐ **Model EG Equalizing Grid**

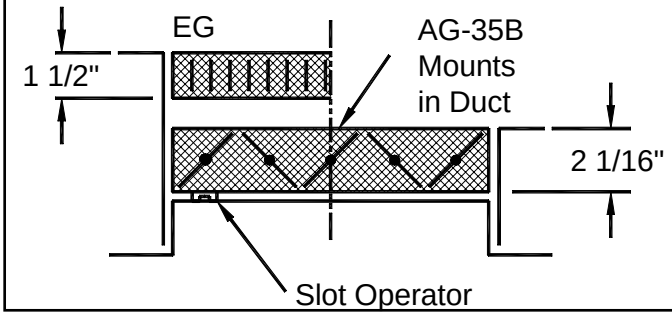


Accessories (Optional) for Rectangular Neck

Check ☐ if provided

☐ **Model AG-35B Opposed Blade Damper**

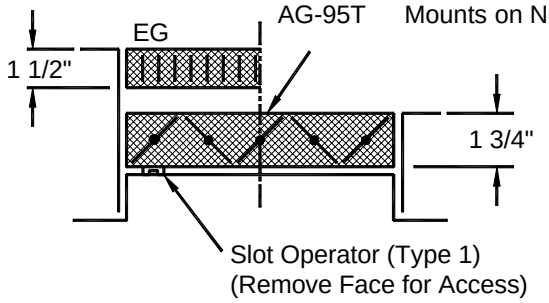
☐ **Model EG Equalizing Grid**



All dimensions are in inches.

☐ **Model AG-95 Opposed Blade Damper with Slot Operator**

☐ **Model EG Equalizing Grid**



Accessories (Optional)

Check ☐ if provided

Accessories		Nominal Round Duct Sizes					
		6	8	10	12	14	16
☐	AG-100	•	•	•	•	•	N/A
☐	D-100	•	•	•	•	•	N/A
☐	AG-85	•	•	•	•	•	•
☐	AG-65	•	•	•	•	•	•
☐	EG	•	•	•	•	•	•
☐	EQT	•	•	•	•	•	•

• Available Sizes

Accessories		Nominal Rectangular Duct Sizes
☐	AG-95 Type 1	Available in Sizes 6 x 6 through 18 x 18
☐	AG-35B	
☐	EG-L/EG-S	
☐	AG-65-L/AG-65-S	
☐	EQT	

(Please see reverse side).

Other Accessories (Optional)

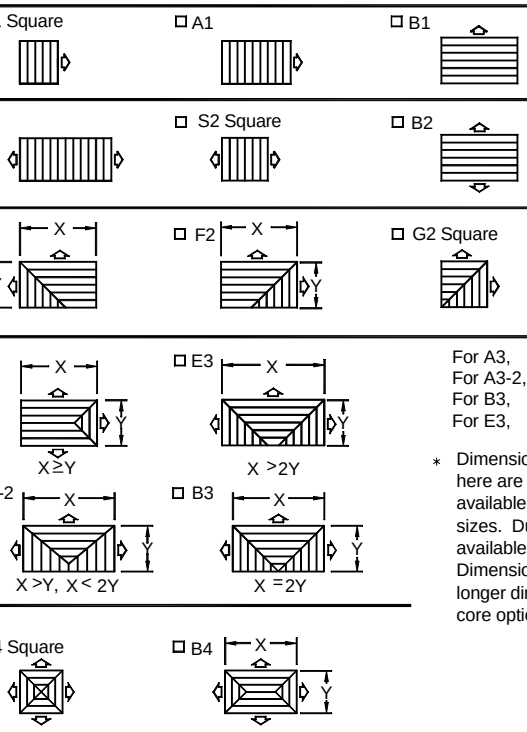
Standard Finish: #26 White

☐ **Model SR Square-to-Round Transition**

Optional Patterns

Check ☐ selection

1 Way	☐ S1 Square	☐ A1	☐ B1
2 Way	☐ A2	☐ S2 Square	☐ B2
2 Way Corner	☐ E2	☐ F2	☐ G2 Square
3 Way	☐ A3 ($X \geq Y$); ☐ E3 ($X > 2Y$); ☐ A3-2 ($X > Y$, $X < 2Y$); ☐ B3 ($X = 2Y$)		
4 Way	☐ A4 Square	☐ B4	

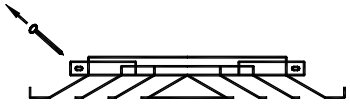


For A3, $X > Y$
For A3-2, $X > Y, X < 2Y$
For B3, $X = 2Y$
For E3, $X > 2Y$

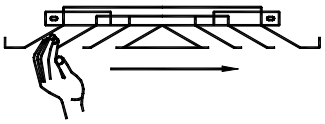
* Dimensions X and Y shown here are the proportions of available rectangular duct sizes. Duct sizes are available in 3" increments. Dimension X is always the longer dimension for each core option.

Removing Center Core

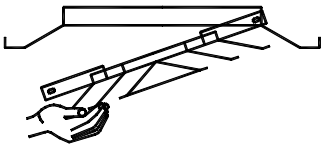
1. Remove shipping clips.



2. Push core sideways against spring.



3. Hold core securely and allow to drop down.



General Description

- TITUS Model TDV is a high capacity ceiling diffuser. Because it maintains an unbroken horizontal flow pattern from maximum cfm down to minimum, it is an excellent choice for variable air volume application.
- Core is removable from the face of the diffuser.
- Slot operator on optional, neck-mounted Model AG-95 damper allows easy volume adjustment by removing the diffuser core. (Rectangular necks only).
- Model TDV is extremely flexible, with cores available for 1, 2, 3 or 4-way horizontal flow patterns.
- Material is heavy gauge steel.
- The TITUS TDV has louvered face with integrated induction vanes for exceptional air mixing.

Performance Data • Round Neck

TDV • Louvered Face, Induction Vanes • Horizontal Discharge Pattern

Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	78		98		117		137		156		176		215	
		Total Pressure	0.031		0.050		0.071		0.097		0.126		0.160		0.239	
		NC	9		15		20		24		28		31		37	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
6	S1	X	78	6-9-17	98	7-11-20	117	9-13-21	137	10-15-23	156	12-17-25	176	13-19-26	215	16-21-29
x	S2&G2	X & Y	39	3-5-10	49	4-6-12	59	5-7-15	69	6-9-16	78	6-10-17	88	7-11-19	108	9-13-21
6	A3	X	28	3-4-8	37	3-5-9	44	4-6-9	52	5-7-10	59	5-8-11	66	6-8-12	81	7-9-13
6"		Y	19	2-3-6	25	3-4-8	29	3-5-9	34	4-5-10	39	4-6-11	44	5-7-12	54	6-8-13
Round	A4	X & Y	19	2-3-6	29	3-4-8	34	3-5-9	39	4-5-10	44	4-6-11	54	5-7-12	64	6-8-13
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	98		117		137		156		176		215		254	
		Total Pressure	0.050		0.071		0.097		0.126		0.160		0.239		0.334	
		NC	15		20		24		28		31		37		41	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
9	S1	X	98	7-11-20	117	9-13-21	137	10-15-23	156	12-17-25	176	13-19-26	215	16-21-29	254	18-22-32
x	S2&G2	X & Y	49	4-6-12	59	5-7-15	69	6-9-16	78	6-10-17	88	7-11-19	108	9-13-21	127	11-16-22
9	A3	X	37	3-5-9	44	4-6-9	52	5-7-10	59	5-8-11	66	6-8-12	81	7-9-13	96	8-10-14
6"		Y	25	3-4-8	29	3-5-9	34	4-5-10	39	4-6-11	44	5-7-12	54	6-8-13	64	7-10-14
Round	A4	X & Y	25	3-4-8	29	3-5-9	34	4-5-10	39	4-6-11	44	5-7-12	54	6-8-13	64	7-10-14
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	139		174		209		244		279		314		383	
		Total Pressure	0.032		0.049		0.071		0.097		0.127		0.161		0.239	
		NC	10		16		21		25		29		32		38	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
9	S1	X	139	8-12-23	174	10-15-26	209	12-18-29	244	14-21-31	279	16-23-33	314	18-25-35	383	22-27-39
x	S2&G2	X & Y	70	4-6-13	87	5-8-16	105	6-10-19	122	8-11-22	140	9-13-23	157	10-15-25	192	12-18-27
9	A3	X	52	4-5-10	66	4-7-11	79	5-8-13	92	6-9-14	105	7-10-15	119	8-11-15	145	10-12-17
8"		Y	35	3-4-8	44	3-5-10	52	4-6-12	61	5-7-14	70	6-8-15	79	6-9-16	96	8-11-17
Round	A4	X & Y	35	3-4-8	44	3-5-10	52	4-6-12	61	5-7-14	70	6-8-15	79	6-9-16	96	8-11-17
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	174		209		244		279		314		383		453	
		Total Pressure	0.049		0.071		0.097		0.127		0.161		0.239		0.335	
		NC	16		21		25		29		32		38		42	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
12	S1	X	174	10-15-26	209	12-18-29	244	14-21-31	279	16-23-33	314	18-25-35	383	22-27-39	453	24-30-42
x	S2&G2	X & Y	87	5-8-16	105	6-10-19	122	8-11-22	140	9-13-23	157	10-15-25	192	12-18-27	227	14-21-30
12	A3	X	66	4-7-11	79	5-8-13	92	6-9-14	105	7-10-15	119	8-11-15	145	10-12-17	171	11-13-18
8"		Y	44	3-5-10	52	4-6-12	61	5-7-14	70	6-8-15	79	6-9-16	96	8-11-17	113	9-13-19
Round	A4	X & Y	44	3-5-10	52	4-6-12	61	5-7-14	70	6-8-15	79	6-9-16	96	8-11-17	113	9-13-19
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	218		272		327		381		447		490		599	
		Total Pressure	0.032		0.049		0.072		0.097		0.127		0.161		0.240	
		NC	11		17		22		26		30		33		38	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
12	S1	X	218	10-15-29	272	12-18-33	327	15-22-36	381	17-26-39	436	20-29-41	490	22-31-44	599	27-34-48
x	S2&G2	X & Y	109	5-8-16	136	7-10-20	164	8-12-24	191	9-14-27	218	11-16-29	245	12-18-31	300	15-22-34
12	A3	X	82	4-7-13	103	6-8-14	123	7-10-16	144	8-12-17	165	9-13-18	185	10-14-19	226	12-15-21
10"		Y	55	3-5-10	68	4-6-13	82	5-8-16	95	6-9-17	109	7-10-18	123	8-12-20	150	9-14-22
Round	A4	X & Y	55	3-5-10	68	4-6-13	82	5-8-16	95	6-9-17	109	7-10-18	123	8-12-20	150	9-14-22
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	235		314		392		471		549		628		706	
		Total Pressure	0.020		0.035		0.055		0.079		0.107		0.140		0.177	
		NC	-		15		20		25		29		33		36	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
12	S1	X	235	9-14-27	314	12-18-35	392	15-23-39	471	18-27-43	549	21-32-46	628	24-35-50	706	27-37-53
x	S2&G2	X & Y	118	5-7-15	157	7-10-20	196	8-12-25	236	10-15-30	275	12-17-33	314	13-20-35	353	15-22-37
12	A3	X	89	4-6-12	119	5-8-15	148	7-10-17	178	8-12-19	207	10-14-20	237	11-15-22	267	12-16-23
12"		Y	59	2-5-10	79	4-6-13	98	5-8-16	118	6-10-19	137	7-11-21	157	8-13-22	177	10-14-23
Round	A4	X & Y	59	2-5-10	79	4-6-13	98	5-8-16	118	6-10-19	137	7-11-21	157	8-13-22	177	10-14-23
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	314		392		471		549		623		706		863	
		Total Pressure	0.035		0.055		0.079		0.107		0.138		0.177		0.264	
		NC	13		19		24		28		32		35		40	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
15	S1	X	314	12-18-35	392	15-23-39	471	18-27-43	549	21-32-46	623	24-35-49	706	27-37-53	863	33-41-58
x	S2&G2	X & Y	157	7-10-20	196	8-12-25	236	10-15-30	275	12-17-33	312	13-20-35	353	15-22-37	432	18-27-41
15	A3	X	119	5-8-15	148	7-10-17	178	8-12-19	207	10-14-20	235	11-15-22	267	12-16-23	326	15-18-26
12"		Y	79	4-6-13	98	5-8-16	118	6-10-19	137	7-11-21	156	8-13-22	177	10-14-23	216	12-17-26
Round	A4	X & Y	79	4-6-13	98	5-8-16	118	6-10-19	137	7-11-21	156	8-13-22	177	10-14-23	216	12-17-26

- All pressures are in inches of water.
- Throw velocities given are for isothermal terminal velocities of 150, 100 and 50 fpm. See the section, Engineering Guidelines for additional information.
- NC values based on Octave Band 2 to 7 sound power levels minus a room absorption of 10 dB.
- Dash (-) in space denotes an NC value less than 10.
- Data obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006.
- Throw values given are for isothermal conditions.

For Performance Notes, please refer to page F166.

Performance Data • Round Neck (continued)
TDV • Louvered Face, Induction Vanes • Horizontal Discharge Pattern

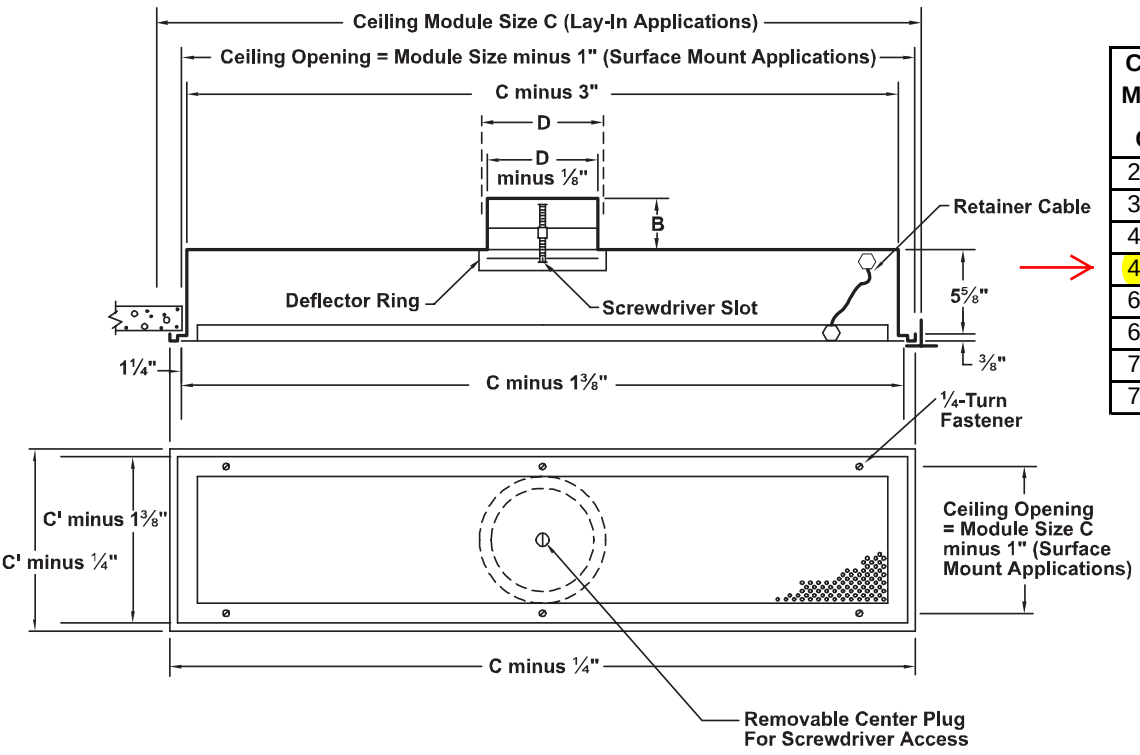
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	320		427		534		641		748		855		863	
		Total Pressure	0.018		0.032		0.050		0.072		0.097		0.127		0.130	
		NC	5		12		18		23		27		31		31	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
15 x 15 14" Round	S1	X	320	10-15-31	427	14-21-41	534	17-26-46	641	21-31-50	748	24-36-54	855	28-41-58	863	28-41-58
	S2&G2	X & Y	160	6-9-17	214	8-11-23	267	9-14-28	321	11-17-34	374	13-20-38	428	15-23-41	432	15-23-41
	A3	X	121	4-7-14	161	6-9-18	202	8-12-20	242	9-14-22	282	11-16-24	323	12-18-25	326	13-18-26
		Y	80	3-5-11	107	5-7-14	134	6-9-18	160	7-11-22	187	8-13-24	214	10-14-26	216	10-15-26
	A4	X & Y	80	3-5-11	107	5-7-14	134	6-9-18	160	7-11-22	187	8-13-24	214	10-14-26	216	10-15-26
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	98		117		137		156		176		215		254	
		Total Pressure	0.048		0.069		0.094		0.122		0.155		0.232		0.324	
		NC	15		20		24		28		31		37		41	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
18 x 18 6" Round	S1	X	98	7-11-20	117	9-13-21	137	10-15-23	156	12-17-25	176	13-19-26	215	16-21-29	254	18-22-32
	S2&G2	X & Y	49	4-6-12	59	5-7-15	69	6-9-16	78	6-10-17	88	7-11-19	108	9-13-21	127	11-16-22
	A3	X	37	3-5-9	44	4-6-9	52	5-7-10	59	5-8-11	66	6-8-12	81	7-9-13	96	8-10-14
		Y	25	3-4-8	29	3-5-9	34	4-5-10	39	4-6-11	44	5-7-12	54	6-8-13	64	7-10-14
	A4	X & Y	25	3-4-8	29	3-5-9	34	4-5-10	39	4-6-11	44	5-7-12	54	6-8-13	64	7-10-14
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	174		209		244		279		314		383		453	
		Total Pressure	0.047		0.067		0.092		0.120		0.152		0.226		0.317	
		NC	16		21		25		29		32		38		42	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
18 x 18 8" Round	S1	X	174	10-15-26	209	12-18-29	244	14-21-31	279	16-23-33	314	18-25-35	383	22-27-39	453	24-30-42
	S2&G2	X & Y	87	5-8-16	105	6-10-19	122	8-11-22	140	9-13-23	157	10-15-25	192	12-18-27	227	14-21-30
	A3	X	66	4-7-11	79	5-8-13	92	6-9-14	105	7-10-15	119	8-11-15	145	10-12-17	171	11-13-18
		Y	44	3-5-10	52	4-6-12	61	5-7-14	70	6-8-15	79	6-9-16	96	8-11-17	113	9-13-19
	A4	X & Y	44	3-5-10	52	4-6-12	61	5-7-14	70	6-8-15	79	6-9-16	96	8-11-17	113	9-13-19
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	218		272		327		381		436		490		599	
		Total Pressure	0.029		0.045		0.066		0.089		0.117		0.147		0.220	
		NC	11		17		22		26		30		33		38	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
18 x 18 10" Round	S1	X	218	10-15-29	272	12-18-33	327	15-22-36	381	17-26-39	436	20-29-41	490	22-31-44	599	27-34-48
	S2&G2	X & Y	109	5-8-16	136	7-10-20	164	8-12-24	191	9-14-27	218	11-16-29	245	12-18-31	300	15-22-34
	A3	X	82	4-7-13	103	6-8-14	123	7-10-16	144	8-12-17	165	9-13-18	185	10-14-19	226	12-15-21
		Y	55	3-5-10	68	4-6-13	82	5-8-16	95	6-9-17	109	7-10-18	123	8-12-20	150	9-14-22
	A4	X & Y	55	3-5-10	68	4-6-13	82	5-8-16	95	6-9-17	109	7-10-18	123	8-12-20	150	9-14-22
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	314		392		471		549		623		706		863	
		Total Pressure	0.031		0.048		0.070		0.095		0.122		0.157		0.234	
		NC	13		19		24		28		32		35		40	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
18 x 18 12" Round	S1	X	314	12-18-35	392	15-23-39	471	18-27-43	549	21-32-46	623	24-35-49	706	27-37-53	863	33-41-58
	S2&G2	X & Y	157	7-10-20	196	8-12-25	236	10-15-30	275	12-17-33	312	13-20-35	353	15-22-37	432	18-27-41
	A3	X	119	5-8-15	148	7-10-17	178	8-12-19	207	10-14-20	235	11-15-22	267	12-16-23	326	15-18-26
		Y	79	4-6-13	98	5-8-16	118	6-10-19	137	7-11-21	156	8-13-22	177	10-14-23	216	12-17-26
	A4	X & Y	79	4-6-13	98	5-8-16	118	6-10-19	137	7-11-21	156	8-13-22	177	10-14-23	216	12-17-26
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	427		534		641		748		855		962		1175	
		Total Pressure	0.027		0.042		0.060		0.081		0.106		0.135		0.201	
		NC	12		18		23		27		31		34		40	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
18 x 18 14" Round	S1	X	427	14-21-41	534	17-26-46	641	21-31-50	748	24-36-54	855	28-41-58	962	31-43-61	1175	38-48-68
	S2&G2	X & Y	214	8-11-23	267	9-14-28	321	11-17-34	374	13-20-38	428	15-23-41	481	17-26-43	588	21-31-48
	A3	X	161	6-9-18	202	8-12-20	242	9-14-22	282	11-16-24	323	12-18-25	363	14-19-27	444	17-21-30
		Y	107	5-7-14	134	6-9-18	160	7-11-22	187	8-13-24	214	10-14-26	241	11-16-27	294	13-20-30
	A4	X & Y	107	5-7-14	134	6-9-18	160	7-11-22	187	8-13-24	214	10-14-26	241	11-16-27	294	13-20-30
Return Factors -SP = 1.1 TP Add 1 to NC		Total cfm	628		698		837		977		1256		1530		1808	
		Total Pressure	0.032		0.039		0.056		0.077		0.126		0.188		0.262	
		NC	16		19		24		28		35		40		45	
		Side	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw	cfm	Throw
18 x 18 16" Round	S1	X	628	18-27-50	698	20-30-52	837	24-35-57	977	28-41-62	1256	35-50-70	1530	43-55-77	1808	49-60-84
	S2&G2	X & Y	314	10-15-29	349	11-16-32	419	13-19-39	488	15-23-44	628	19-29-50	765	24-36-55	904	28-42-60
	A3	X	237	8-12-22	263	9-13-23	316	11-16-25	369	12-19-27	474	16-22-31	578	20-24-34	683	21-26-37
		Y	157	6-9-19	174	7-10-21	209	8-12-25	244	10-14-28	314	12-19-31	383	15-23-35	452	18-27-38
	A4	X & Y	157	6-9-19	174	7-10-21	209	8-12-25	244	10-14-28	314	12-19-31	383	15-23-35	452	18-27-38

- All pressures are in inches of water.
- Throw velocities given are for isothermal terminal velocities of 150, 100 and 50 fpm. See the section, Engineering Guidelines for additional information.
- NC values based on Octave Band 2 to 7 sound power levels minus a room absorption of 10 dB.
- Dash (-) in space denotes an NC value less than 10.
- Data obtained from tests conducted in accordance with ANSI/ASHRAE Standard 70-2006.
- Throw values given are for isothermal conditions.

For Performance Notes, please refer to page F166.

TLF • Removable Face • Distribution and Volume Damper

Critical Environment Diffusion Products
Laminar Flow Ceiling Diffusers • Steel • Perforated Face



Ceiling Module C x C'	Duct Size D
24 x 24	6, 7, 8, 10, 12
36 x 24	6, 7, 8, 10, 12
48 x 12	6, 7, 8
48 x 24	6, 7, 8, 10, 12
60 x 12	6, 7, 8
60 x 24	6, 7, 8, 10, 12
72 x 12	6, 7, 8
72 x 24	6, 7, 8, 10, 12

Duct Size D	Neck Size B
6, 7, 8	2 1/4
10, 12	2 3/4

Table indicates Availablel Ceiling Modules Sizes
C x C' and Nominal Round Duct Sizes D.

Accessories (Optional) Check ☑ if provided.

☐ Earthquake Tabs

Standard Finish: #26 White

General Description

- Model TLF laminar flow diffuser generates a low velocity, evenly distributed, downward moving “piston” of conditioned air.
- Installed over the operating table in a hospital operating room, Model TLF helps to protect the patient from contaminated air. The only appreciable amount of room air entrainment occurs at the boundaries of the moving air mass outside the confines of the operating table. As a result, the patient is effectively isolated from residual room air.
- Model TLF is especially effective in cooling areas with heavy, localized, internal loads, as in the computer room. The column of air delivered by the Model TLF cools the load source directly without generating high velocities in the occupied space.
- Disk type damper in neck is adjustable by rotating entire disk. Accessible after removing center plug.
- Perforated face is quickly removed by loosening 1/4 turn fasteners.
- Retainer cables prevent accidental dropping of perforated face after removal.
- Internal baffles distribute air evenly over perforated face.
- Perforated face has 3/32” diameter holes on ¼” centers on 60° staggered pattern.
- Can be surfaced mounted (left side of drawing above) or laid into conventional T-bar ceiling system (right side of drawing above).
- Compatible with 1" or 1½" T-bar ceiling grids.

Critical Environment Diffusers

PERFORMANCE DATA

TLF, TLF-AA AND TLF-SS

7″ Round Inlet	Airflow (CFM)	100	120	140	160	180	220	240	260	300
48″ x 12″ Module	Total Pressure	0.035	0.050	0.068	0.090	0.114	0.170	0.200	0.235	0.313
	NC (noise Criteria)	11	16	20	24	28	34	37	40	44
	Vertical Projection	1-2-3	1-3-4	1-4-5	2-4-5	2-5-6	4-6-7	4-7-8	5-8-9	6-9-10
60″ x 12″ Module	Total Pressure	0.035	0.050	0.068	0.090	0.114	0.170	0.200	0.235	0.313
	NC (noise Criteria)	11	16	20	24	28	34	37	40	44
	Vertical Projection	1-2-3	1-3-4	1-4-5	2-4-5	2-5-6	3-6-7	4-6-8	4-7-8	6-8-9
72″ x 12″ Module	Total Pressure	0.035	0.050	0.068	0.090	0.114	0.170	0.200	0.235	0.313
	NC (noise Criteria)	11	16	20	24	28	34	36	39	43
	Vertical Projection	1-2-3	1-3-4	1-4-5	2-4-5	2-5-6	3-6-7	4-6-8	4-7-8	5-8-9
24″ x 24″ Module	Total Pressure	0.035	0.050	0.068	0.090	0.114	0.170	0.200	0.235	0.313
	NC (noise Criteria)	11	16	20	24	28	34	37	40	44
	Vertical Projection	1-2-3	1-3-4	1-4-5	2-4-5	2-5-6	3-6-7	4-7-8	5-7-8	6-8-9
36″ x 24″ Module	Total Pressure	0.035	0.050	0.068	0.090	0.114	0.170	0.200	0.235	0.313
	NC (noise Criteria)	11	16	20	24	28	34	37	40	44
	Vertical Projection	1-2-3	1-3-4	1-4-5	2-4-5	2-4-5	3-5-6	3-6-7	4-7-8	5-8-9
48″ x 24″ Module	Total Pressure	0.035	0.050	0.068	0.090	0.114	0.170	0.200	0.235	0.313
	NC (noise Criteria)	11	16	20	24	28	33	36	39	43
	Vertical Projection	1-2-3	1-2-4	1-3-5	1-4-5	2-4-5	3-5-6	3-6-7	4-7-8	5-7-9

8″ Round Inlet	Airflow (CFM)	100	120	140	160	180	220	240	260	300
48″ x 24″ Module	Total Pressure	0.020	0.027	0.038	0.050	0.062	0.090	0.113	0.130	0.175
	NC (noise Criteria)	-	-	14	18	22	28	31	33	37
	Vertical Projection	1-2-3	1-2-3	1-3-4	1-3-4	1-4-5	2-5-6	2-5-6	3-6-7	4-7-8
60″ x 24″ Module	Total Pressure	0.020	0.027	0.038	0.049	0.061	0.089	0.109	0.126	0.168
	NC (noise Criteria)	-	-	14	18	22	28	31	33	37
	Vertical Projection	1-2-3	1-2-3	1-3-4	1-3-4	1-4-5	2-5-6	2-5-6	3-6-7	3-7-8
72″ x 24″ Module	Total Pressure	0.019	0.027	0.037	0.048	0.060	0.088	0.105	0.124	0.162
	NC (noise Criteria)	-	-	14	18	22	28	31	33	37
	Vertical Projection	1-2-3	1-2-3	1-3-4	1-3-4	1-4-5	2-5-6	2-5-6	3-5-7	3-6-8

10″ Round Inlet	Airflow (CFM)	215	240	265	295	320	345	400	425	515
48″ x 24″ Module	Total Pressure	0.043	0.053	0.065	0.080	0.094	0.110	0.147	0.166	0.244
	NC (noise Criteria)	19	22	25	28	31	33	38	40	45
	Vertical Projection	1-4-5	1-4-5	2-5-6	2-5-6	2-6-7	3-6-7	4-8-9	4-8-9	6-10-11
60″ x 24″ Module	Total Pressure	0.043	0.053	0.065	0.079	0.094	0.110	0.147	0.166	0.244
	NC (noise Criteria)	19	22	25	28	31	33	38	40	45
	Vertical Projection	1-4-5	1-4-5	2-5-6	2-5-6	2-6-7	3-6-7	3-7-8	4-8-9	6-10-11
72″ x 24″ Module	Total Pressure	0.042	0.052	0.063	0.079	0.092	0.107	0.145	0.163	0.240
	NC (noise Criteria)	19	22	25	28	31	33	38	40	45
	Vertical Projection	1-4-5	1-4-5	2-5-6	2-5-6	2-6-7	3-6-7	3-7-8	4-8-9	6-9-11

12″ Round Inlet	Airflow (CFM)	215	240	265	295	320	345	400	425	515
48″ x 24″ Module	Total Pressure	0.023	0.029	0.035	0.043	0.051	0.059	0.080	0.090	0.132
	NC (noise Criteria)	11	15	18	22	24	27	32	34	40
	Vertical Projection	1-4-4	1-4-5	1-4-5	1-5-6	2-6-6	2-7-7	2-7-8	3-7-8	4-9-10
60″ x 24″ Module	Total Pressure	0.023	0.029	0.035	0.043	0.051	0.059	0.080	0.090	0.132
	NC (noise Criteria)	11	15	18	22	24	27	32	34	40
	Vertical Projection	1-4-4	1-4-5	1-4-5	1-5-6	2-6-6	2-6-7	2-7-8	3-7-8	4-8-10
72″ x 24″ Module	Total Pressure	0.023	0.028	0.034	0.042	0.050	0.058	0.078	0.088	0.129
	NC (noise Criteria)	11	15	18	22	24	27	32	34	40
	Vertical Projection	1-4-4	1-4-5	1-4-5	1-5-6	2-5-6	2-6-7	2-7-7	2-7-8	3-8-10

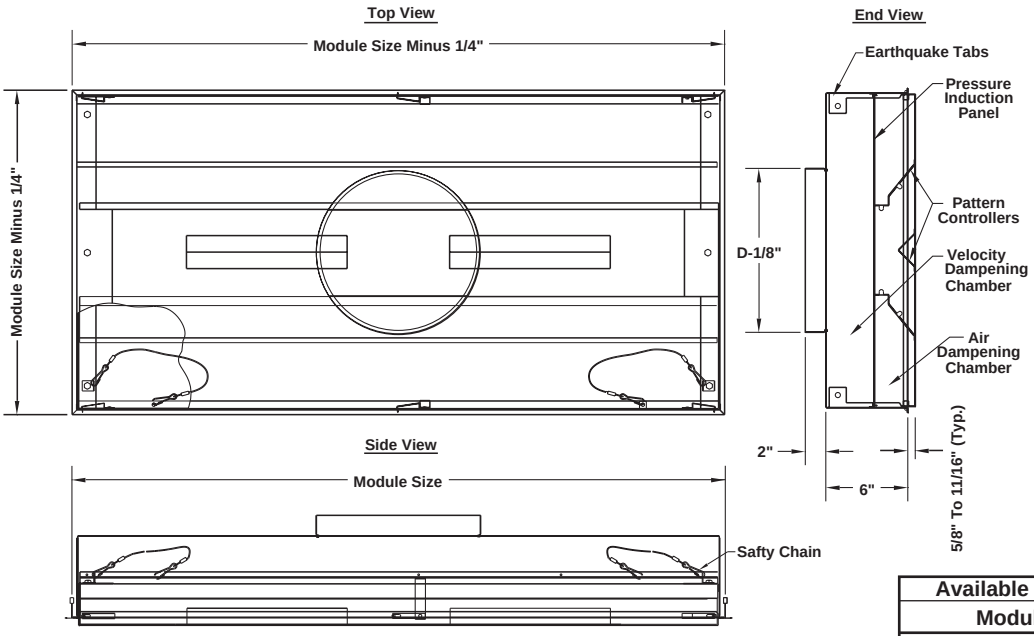
- All data based on full open damper position.
- NC values are based on a room absorption of 10 dB.
- Data obtained in accordance with ASHRAE 70-2006 and 113.
- Throw is based on 0-5° cooling with terminal velocities of 75, 50 and 30 fpm.
- Performance data does not include pressure loss of optional HEPA filter.
- See the section, Engineering Guidelines and the topic 'Procedure to Obtain Catalog Throw Data' in this catalog for throw information.
- Performance data for additional sizes not shown can be obtained by using the Titus TEAMS program.

Critical Environment Diffusion Products
High Volume • Low Velocity • Radial Air Diffusion

Model: ☐ **TriTec** • **Steel**

☐ **TriTec-AL** • **Aluminum Backpan • 304 Stainless Steel Face**

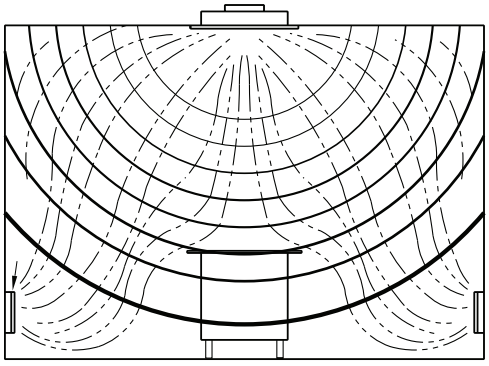
☐ **TriTec-SS** • **304 Stainless Steel**



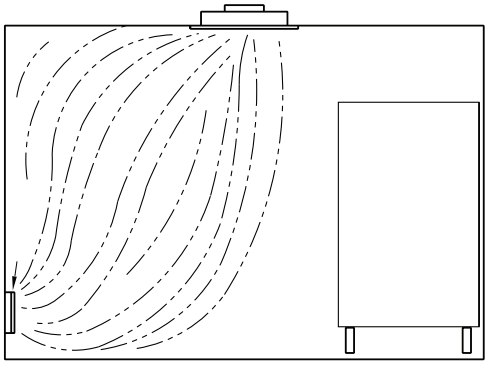
Available Inlet Sizes	
Module Size	
24” x 24”	24” x 48”
8” Dia.	10” Dia.
10” Dia.	12” Dia.

Note: Hemispherical pattern diffuser shown. All dimensions are identical for one-way pattern diffusers

☐ **TriTec Hemispherical Pattern (2-way)**



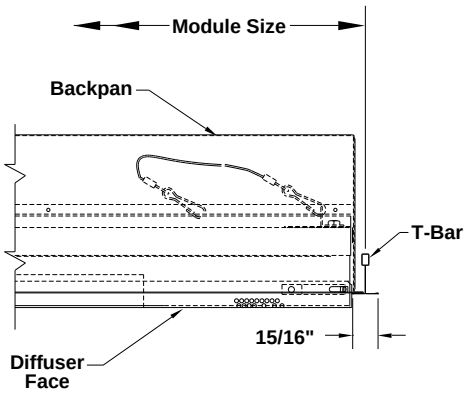
☐ **TriTec One-Way Pattern**



(Please see reverse side.)

Submittal CED-TriTec 2-28-13

☐ **Lay-In**



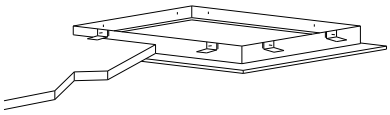
Note: Not for Narrow Tee applications.

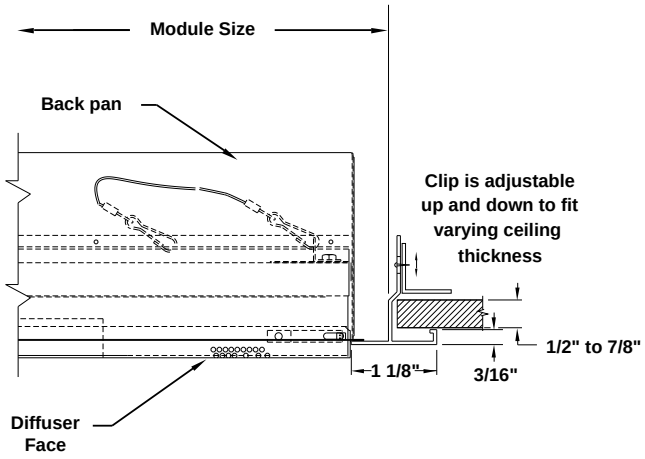
Standard Finish:
For steel and aluminum products
#26 White

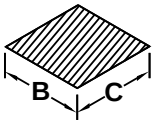
Standard Finish:
For stainless steel products
#04 Mill

☐ Optional Finish _____

☐ TRM • Aluminum TITUS Rapid Mount Frame.
☐ TRMS • Steel TITUS Rapid Mount Frame.







*Recommended Ceiling Opening		
Ceiling Module	**B**	**C**
24 x 24	24 1/2	24 1/2
24 x 48	48 1/2	24 1/2

Check actual dimensions of ceiling opening before installation.

General Description

- TriTec hemispherical face drops below the ceiling 5/8".
- Removable face for sanitizing, (no special tool required to remove the face).
- Available in Steel, 304 Stainless Steel, and Aluminum with 304 Stainless Steel face.
- Available in 24" x 24" and 48" x 24" module sizes.
- Low velocity hemispherical (2-way) pattern or one-way pattern available.
- Factory supplied plenum with every unit.
- Standard unit lays into standard T-Bar ceiling. Optional TRM/TRMS mounting frame available for surface mounting.
- Simple to install and maintain.
- Great for use in fume hood areas.
- Earthquake tabs supplied as standard.
- Safety chain is standard.
- 51% free area perforated face matches industry standard perforated diffuser's appearance.
- 22 gauge backpan.

Note: This submittal is meant to demonstrate general dimensions of this product. The drawings on this submittal are not meant to detail every aspect of the product with exactness. Drawings are not to scale. TITUS reserves the right to make changes without written notice.

605 Shiloh Road • Plano, Texas 75074 • 972-212-4800

PERFORMANCE DATA

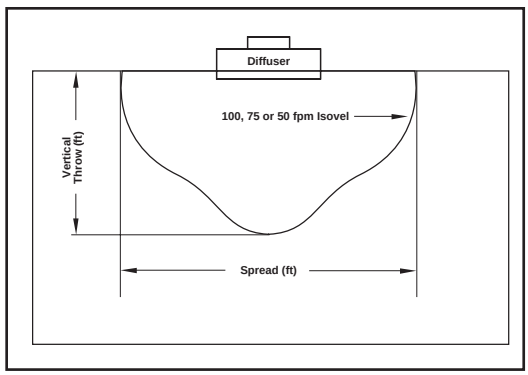
Critical Environment Diffusers

TRITEC, TRITEC-AL AND TRITEC-SS

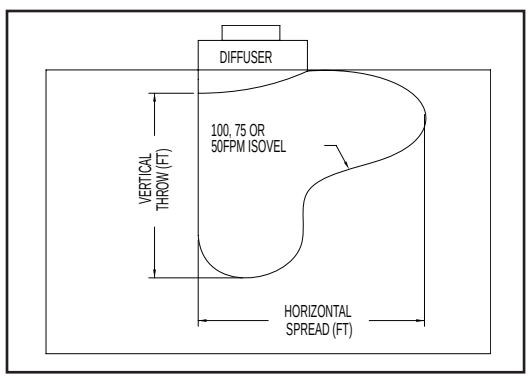
Module Size and Inlet Size	2-Way Pattern				Horizontal Spread (ft)			Vertical Throw (ft) 5 Deg ΔT			10 Deg ΔT			15 Deg ΔT		
	cfm	Ps	Pt	Nc	100-75-50			100-75-50			100-75-50			100-75-50		
24″ X 24″ 8″ Inlet	250	0.055	0.087	25	1	2	5	1	2	3	1	2	3	1	2	4
	300	0.080	0.126	29	2	3	6	1	3	4	1	2	4	2	3	5
	400	0.142	0.224	37	3	5	7	3	3	5	2	4	5	3	5	7
	500	0.222	0.350	42	5	6	8	3	4	5	3	5	7	4	6	8
24″ X 24″ 10″ Inlet	250	0.026	0.039	<20	1	1	3	0	1	2	0	1	2	1	1	2
	300	0.037	0.056	20	1	2	4	1	1	2	1	1	3	1	1	3
	475	0.093	0.140	31	3	5	7	1	3	6	2	3	6	2	4	7
	600	0.148	0.224	37	4	6	9	2	4	8	3	5	8	3	6	9
24″ X 48″ 10″ Inlet	375	0.054	0.084	<20	3	4	6	0	1	1	1	1	2	1	1	2
	500	0.097	0.149	26	4	6	9	1	1	3	1	2	4	1	2	4
	700	0.190	0.292	39	6	8	10	1	2	5	2	4	6	2	4	7
	900	0.313	0.483	48	8	10	12	2	4	7	3	5	8	3	6	9
24″ X 48″ 12″ Inlet	500	0.054	0.080	20	1	2	4	1	1	2	1	1	3	1	2	4
	650	0.092	0.135	24	2	3	7	1	2	4	1	2	5	2	3	6
	750	0.122	0.179	34	2	4	9	1	2	5	2	3	6	2	4	7
	1000	0.218	0.319	44	4	7	11	2	4	6	3	5	8	4	6	9
Module Size and Inlet Size	1-Way Pattern				Horizontal Spread (ft)			Vertical Throw (ft) 5 Deg ΔT			10 Deg ΔT			15 Deg ΔT		
	cfm	Ps	Pt	NC	100-75-50			100-75-50			100-75-50			100-75-50		
24″ X 24″ 8″ Inlet	250	0.055	0.087	<20	1	2	3	0	0	1	1	1	2	1	1	3
	325	0.094	0.148	29	2	3	4	0	1	2	1	2	4	1	2	5
	400	0.142	0.224	35	3	3	4	1	1	3	2	3	6	2	4	8
	450	0.179	0.283	38	3	4	4	1	1	3	2	3	9	3	5	9
24″ X 24″ 10″ Inlet	250	0.025	0.038	<20	1	2	4	1	1	3	1	1	3	2	3	7
	350	0.049	0.075	22	3	4	6	1	2	5	2	3	6	4	6	9
	450	0.081	0.123	28	4	5	7	2	4	6	3	5	7	6	8	9
	550	0.121	0.184	34	4	6	8	3	5	7	4	6	9	7	9	9
24″ X 48″ 10″ Inlet	500	0.092	0.144	24	1	2	3	1	2	4	1	2	4	3	6	9
	625	0.143	0.225	32	2	2	4	2	3	5	2	3	6	5	8	9
	750	0.206	0.324	39	2	3	4	2	4	6	2	4	7	7	9	9
	900	0.297	0.467	44	3	4	6	4	5	8	4	7	9	8	9	9
24″ X 48″ 12″ Inlet	500	0.051	0.076	<20	1	2	3	2	4	7	4	6	8	4	6	8
	650	0.086	0.129	25	2	3	4	4	6	9	6	7	9	6	7	9
	750	0.114	0.171	31	3	3	5	5	7	9	6	8	9	6	8	9
	1000	0.203	0.304	42	3	5	7	7	9	9	8	9	9	8	9	9

- Spread is the maximum width of the isovel at the indicated terminal velocity.
- Vertical throw is the furthest distance below the ceiling where the indicated terminal velocity can be measured.
- Tests were conducted in a 16 x 16-foot room, with a 9-foot ceiling, low side wall returns, in accordance with ASHRAE Standard 113, in several planes.
- Low emissivity heaters were used to maintain loads, and were set to match the supply air conditions. The room was free of obstructions during the tests.
- Sound and pressure drop tests were conducted in accordance with ASHRAE.
- Standard 70-2006 and ANSI S1.31 Procedures.

2-WAY PATTERN



1-WAY PATTERN



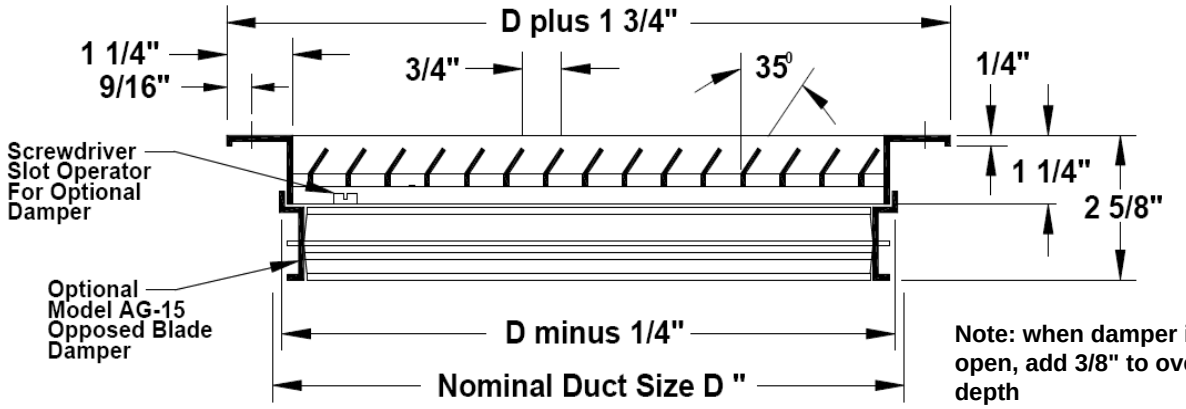
Titus Submittal

G-350F-1.0 10-1-10

☐ **350FL** • 35° Deflection • Long Blades • ¾" Blades Spacing
☐ **350FS** • 35° Deflection • Short Blades • ¾" Blades Spacing

Louvered Return Grilles • Aluminum

☐ Border Type 1 (Surface Mount)



Note: when damper is full open, add 3/8" to overall depth

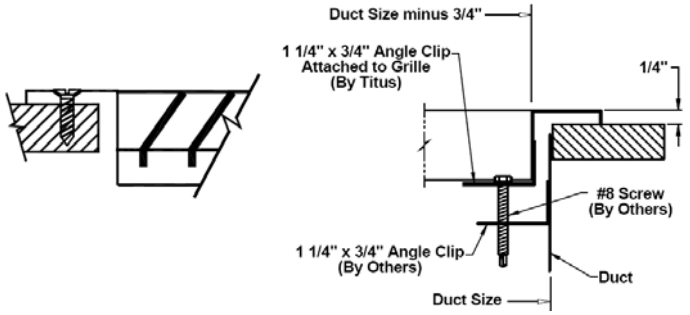
Available Sizes (D" x D")

Border Type 1 is available in sizes 6" x 4" through 48" x 48" in 2" increments in one piece construction. Odd and fractional sizes are available at additional cost. Sizes larger than 48" x 48" are shipped in multiple sections with joining strips for field assembly.

Note: Wall or duct opening should be duct size ± 1/8". All dimensions are in inches.

Fastenings

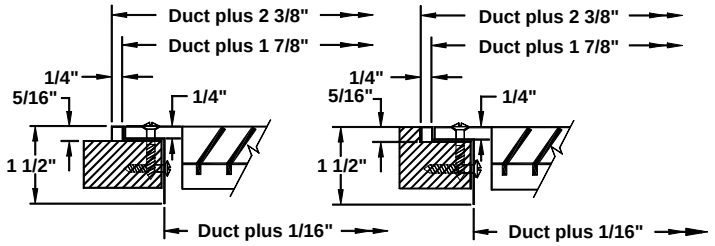
☐ Type A • External Screw ☐ Type C • Concealed Screw



Type A & C available with Border Type 1 only. Type C available with damper

Mounting Frames

☐ PF • Steel Plaster Frame ☐ PFA • Aluminum Plaster Frame



Surface Mounted Example **Recessed Mounted Example**

Note: Wall opening should be listed duct size + 1/8" to listed duct size + 1/4".

Accessories (Optional) Check ☑ if provided.

☐ Neck mounted opposed blade damper (galvanized steel)
☐ EQT • Earthquake Tabs
☐ IS • Insect Screen (1/16" square mesh – galvanized steel)
☐ DS • Debris Screen (¼" square mesh – galvanized steel)
☐ Other: _____

Standard Finish: #26 White

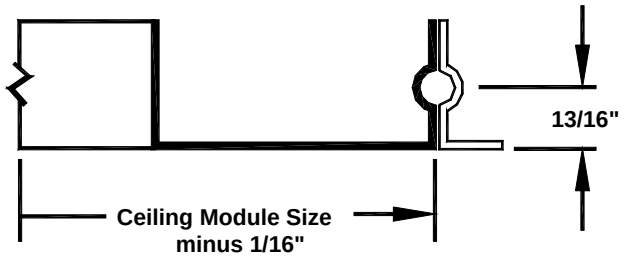
☐ Other Finish: _____

General Description

- Available with louvers vertical or horizontal.
- #8 x 11/4" lg. Phillips flat head sheet metal screws painted white.
- Optional opposed blade damper has screwdriver adjustment accessible through face of grille.
- Insect screen & debris screen are not available with damper option
- Material is Aluminum.
- All dimensions are ± 1/16".

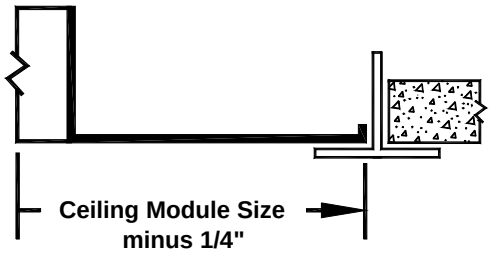
Optional Border Types Available

☐ Border Type 2 (Snap-in)
Panel Mounted



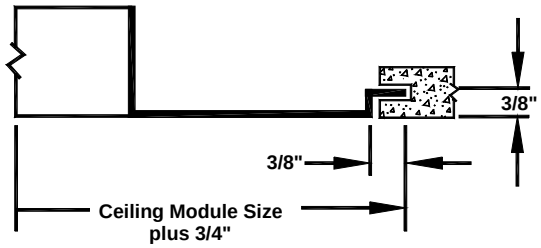
Available in 24” x 24” modules with neck sizes up to 20” x 20”.

☐ Border Type 3 (Lay-in)
Panel Mounted



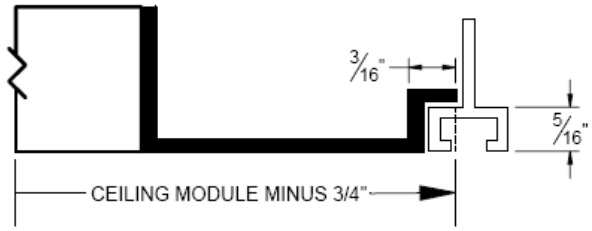
Available in all standard module sizes with neck sizes up to module size minus 2”.

☐ Border Type 4 (Spline)
Panel Mounted



Available in 24” x 24” modules with neck sizes up to 20” x 20”.
Splines on 2 opposite sides only

☐ Border Type NT (Narrow Tee)



NT Border is available in module sizes 24" x 12" & 24" x 24" only.

Border Type 2, 3, 4, NT

- Accessories & Options

Check ☑ if provided.

☐ AG-15 • Neck mounted opposed blade damper (galvanized steel)

☐ IS • Insect Screen (1/16” square mesh – galvanized steel)

☐ DS • Debris Screen (1/4” square mesh – galvanized steel)

☐ EQT • Earthquake tabs

☐ Other: _____

Standard Finish: #26 White

☐ Optional finish: _____

350R, 350F AND 350R-SS
PERFORMANCE BASED ON NOMINAL SIZES SHOWN IN BOLD.

Nominal Duct Size (in.)	Nominal Duct Area (ft²)	Core Area (ft²)	Core Velocity Velocity Pressure Neg. Static Pressure	100 0.001 0.002	200 0.002 0.008	300 0.006 0.018	400 0.010 0.032	500 0.016 0.051	600 0.022 0.073	700 0.031 0.099	800 0.040 0.130	900 0.050 0.164
6x6	**0.25**	**0.19**	Airflow, cfm	19	38	57	76	95	114	133	152	171
			NC	-	-	-	-	-	13	19	25	29
8x6	**0.33**	**0.26**	Airflow, cfm	26	52	78	104	130	156	182	208	234
			NC	-	-	-	-	-	15	20	26	30
10x6	**0.42**	**0.34**	Airflow, cfm	34	68	102	136	170	204	238	272	306
			NC	-	-	-	-	-	16	21	28	32
8x8	**0.44**	**0.37**	Airflow, cfm	37	74	111	148	185	222	259	296	333
			NC	-	-	-	-	-	16	22	28	32
12x6	**0.5**	**0.41**	Airflow, cfm	41	82	123	164	205	246	287	328	369
			NC	-	-	-	-	-	17	22	30	34
14x6	**0.58**	**0.48**	Airflow, cfm	48	96	144	192	240	288	336	384	432
			NC	-	-	-	-	-	18	24	30	34
16x6 **12x8**	**0.67**	**0.57**	Airflow, cfm	57	114	171	228	285	342	399	456	513
			NC	-	-	-	-	10	19	25	30	35
10x10	**0.69**	**0.59**	Airflow, cfm	59	118	177	236	295	354	413	472	531
			NC	-	-	-	-	10	19	25	31	35
18x6	**0.75**	**0.63**	Airflow, cfm	63	126	189	252	315	378	441	504	567
			NC	-	-	-	-	10	19	25	32	35
20x6 **12x10**	**0.83**	**0.72**	Airflow, cfm	72	144	216	288	360	432	504	576	648
			NC	-	-	-	-	11	19	25	30	35
22x6	**0.92**	**0.77**	Airflow, cfm	77	154	231	308	385	462	539	616	693
			NC	-	-	-	-	11	19	25	30	35
24x6 **12x12**	**1**	**0.88**	Airflow, cfm	88	176	264	352	440	528	616	704	792
			NC	-	-	-	-	11	19	25	30	35
30x6 **18x10**	**1.25**	**1.11**	Airflow, cfm	111	222	333	444	555	666	777	888	999
			NC	-	-	-	-	12	20	26	32	35
14x14	**1.36**	**1.22**	Airflow, cfm	122	244	366	488	610	732	854	976	1098
			NC	-	-	-	-	12	20	27	32	35
36x6 **18x12**	**1.5**	**1.35**	Airflow, cfm	135	270	405	540	675	810	945	1080	1215
			NC	-	-	-	-	13	20	27	32	35
22x10	**1.53**	**1.37**	Airflow, cfm	137	274	411	548	685	822	959	1096	1233
			NC	-	-	-	-	13	20	27	32	36
30x8 **24x10**	**1.67**	**1.49**	Airflow, cfm	149	298	447	596	745	894	1043	1192	1341
			NC	-	-	-	-	14	21	27	33	37
42x6 **18x14**	**1.75**	**1.59**	Airflow, cfm	159	318	477	636	795	954	1113	1272	1431
			NC	-	-	-	-	14	21	27	33	37
16x16	**1.78**	**1.62**	Airflow, cfm	162	324	486	648	810	972	1134	1296	1458
			NC	-	-	-	-	14	21	27	33	37
24x12 18x16	**2**	**1.82**	Airflow, cfm	182	364	546	728	910	1092	1274	1456	1638
			NC	-	-	-	-	14	21	28	33	38
18x18	**2.25**	**2.07**	Airflow, cfm	207	414	621	828	1035	1242	1449	1656	1863
			NC	-	-	-	-	14	21	28	33	38
24x14	**2.33**	**2.14**	Airflow, cfm	214	428	642	856	1070	1284	1498	1712	1926
			NC	-	-	-	-	14	22	28	33	38
30x12	**2.5**	**2.29**	Airflow, cfm	229	458	687	916	1145	1374	1603	1832	2061
			NC	-	-	-	-	15	22	28	33	38
24x16	**2.67**	**2.46**	Airflow, cfm	246	492	738	984	1230	1476	1722	1968	2214
			NC	-	-	-	-	15	22	29	34	39
20x20	**2.78**	**2.57**	Airflow, cfm	257	514	771	1028	1285	1542	1799	2056	2313
			NC	-	-	-	-	16	23	29	34	39
36x12	**3**	**2.75**	Airflow, cfm	275	550	825	1100	1375	1650	1925	2200	2475
			NC	-	-	-	-	16	23	29	34	39
30x16 **24x20**	**3.33**	**3.11**	Airflow, cfm	311	622	933	1244	1555	1866	2177	2488	2799
			NC	-	-	-	-	17	24	30	35	40
22x22	**3.36**	**3.14**	Airflow, cfm	314	628	942	1256	1570	1884	2198	2512	2826
			NC	-	-	-	-	17	24	30	35	40
42x12 36x14	**3.5**	**3.22**	Airflow, cfm	322	644	966	1288	1610	1932	2254	2576	2898
			NC	-	-	-	-	17	24	30	36	40
24x22	**3.67**	**3.43**	Airflow, cfm	343	686	1029	1372	1715	2058	2401	2744	3087
			NC	-	-	-	-	17	24	30	36	40
30x18	**3.75**	**3.5**	Airflow, cfm	350	700	1050	1400	1750	2100	2450	2800	3150
			NC	-	-	-	-	17	24	30	36	40

NC-20 NC-30 NC-40

- Static pressures are negative, in inches of water, measured per ANSI/ASHRAE Standard 70-2006.
- NC based on room absorption of 10 dB, re 10^{-12} watts, measured per ANSI/ASHRAE Standard 70-2006.

APPENDIX D

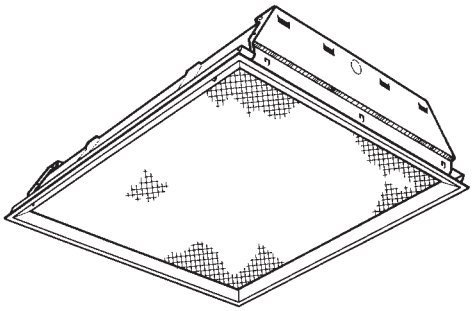
ELECTRICAL

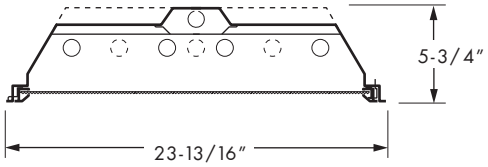
FIXTURE TYPE A1

2′ x 2′ **PREMIUM STATIC TROFFER**

EP STATIC SERIES

VOLTAGE TYPE JOB _____





SPECIFICATIONS

- **Housing** – 22-gauge die-formed C.R.S.
- **Door Frame** – .050″ thick extruded aluminum, flat or regress, with mitered corners.
- **Shielding** – #12 pattern, .125″ acrylic overlay standard–other patterns and thicknesses available.
- **Finish** – 92% minimum average reflective white polyester powder coat bonded to phosphate-free, multi-stage pretreated metal.
- **Electrical** – Electronic ballast standard, instant start T8, program start T5, rated Class P.
- **Labels** – UL/CUL listed as recessed fluorescent luminaire suitable for dry or damp locations. Available for wet locations–consult factory.
- **Mounting** – NEMA Type “G” standard. NEMA Type “F” available.

FEATURES

- Fully-enclosed spring-loaded cam latches allow years of hassle-free maintenance.
- T-slot steel hinge ensures positive retention when door is opened.
- T-slot steel hinge allows reversible hinging and latching.
- 5-3/4″ deep housing with raised ballast wireway eliminates lens shadowing.
- Deep reinforcement ribs provide added strength.
- Optional anti-microbial powder coating available to prevent the spread of dangerous micro-organisms and suppress the growth of mold and bacteria.
- Fully-gasketed door minimizes contaminants.
- Ballast secured by two captive bolts and nuts to ensure a tight, reliable fit for maximum heat dissipation.
- All parts painted after fabrication to facilitate installation, increase efficiency, and inhibit corrosion.
- This fixture is proudly made in the USA.

ORDERING INFORMATION

Submittal

	SERIES	CEILING TYPE		FIXT. STYLE	NOM. W.	NOM. L.		TOTAL LAMPS	WATTAGE/ TYPE	FRAME TYPE	SHIELDING		OPTIONS		BALLAST		VOLTAGE
EXAMPLE:	EP	G	-	S	2	2	-	2	32U	- R	A12125	-	OPTIONS	-	EB2	-	120

SERIES

EP	Premium Static Troffer (No air handling)

CEILING TYPE

G	NEMA Type “G”
F	NEMA Type “F”

FIXTURE STYLE

S	Full door frame, no reveal

NOMINAL WIDTH

2	2′

NOMINAL LENGTH

2	2′

TOTAL LAMPS

2, 3, or 4	

Note: For more options/accessories, ballast combinations, and product details, please consult factory.

LAMP WATTAGE/TYPE

14T5S	2′, 14-watt T5
17	2′, 17-watt T8
24T5H	2′, 24-watt T5HO
31UN	2′, U-bent, 31-watt T8, 1-5/8″ leg spacing
32U	2′, U-bent, 32-watt T8, 6″ leg spacing
40TT	2′, 40-watt long twin tube

DOOR FRAME TYPE

F	White flat aluminum
R	White regress aluminum
FB	Black flat aluminum
RB	Black regress aluminum

SHIELDING

A12125	#12 pattern acrylic, .125″ thick
A19156	#19 pattern acrylic, .156″ thick
PC1SS	Nominal 1/2″x1/2″x1/2″ silver polystyrene
PC2SS	Nominal 1-1/2″x1-1/2″x1″ silver polystyrene

OPTIONS

DG/MYLAR	Double gasket (flat aluminum door only)
TG/MYLAR	Triple gasket (flat aluminum door only)
WET	UL listed suitable for wet location under covered ceiling (flat aluminum door only)
AMW	Anti-microbial white finish

BALLAST TYPE

EB2	2-lamp electronic ballast
EB3	3-lamp electronic ballast
EB4	4-lamp electronic ballast
EB2/2	(2) 2-lamp electronic ballasts

VOLTAGE

120	120V	**UNV**	120-277V
277	277V	**347**	347V

Williams® FLUORESCENT LIGHTING

EP STATIC SERIES

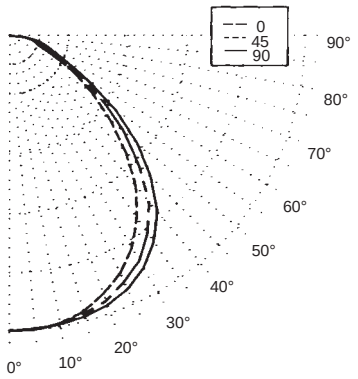
PHOTOMETRY INFORMATION

Williams Catalog #EPG-S22-232U-RA12125-EB2-120
Test Report #8534.0, Dated 11/15/95

Lamp Type: FB032/835/6
Lamp Quantity: 2

CANDLEPOWER DISTRIBUTION

VERT. ANG.	HORIZONTAL ANGLE 0	45	90	ZONAL LUMENS
0	1986.	1986.	1986.	
5	1989.	1986.	1980.	189.6
15	1922.	1940.	1958.	550.7
25	1760.	1824.	1879.	844.3
35	1490.	1614.	1686.	1008.3
45	1103.	1226.	1339.	948.3
55	683.	770.	868.	697.9
65	361.	326.	422.	354.0
75	226.	172.	244.	210.5
85	80.	84.	91.	91.2
90	0.	0.	0.	



LUMEN SUMMARY

ZONE	LUMENS	% LAMP	% FIXTURE
0 - 30	1585.	26.4	32.4
0 - 40	2593.	43.2	53.0
0 - 60	4239.	70.7	86.6
0 - 90	4895.	81.6	100.0
90 - 120	0.	0.	0.
90 - 130	0.	0.	0.
90 - 150	0.	0.	0.
90 - 180	0.	0.	0.
Total Luminaire 0-180	4895.	81.6	100.0

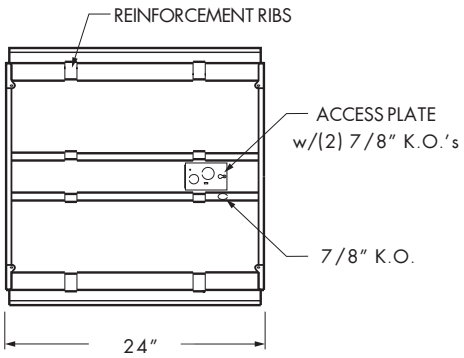
ZONAL CAVITY COEFFICIENTS

EFFECTIVE FLOOR CAVITY REFL. = .20

CEILING	.80			.70			.50		
WALL RCR	.70	.50	.30	.70	.50	.30	.50	.30	.10
0	.97	.97	.97	.95	.95	.95	.91	.91	.91
1	.90	.87	.84	.88	.85	.82	.82	.79	.77
2	.83	.78	.73	.81	.76	.72	.73	.70	.66
3	.77	.70	.64	.75	.68	.63	.66	.62	.58
4	.71	.63	.56	.69	.62	.56	.60	.54	.50
5	.66	.56	.49	.64	.55	.49	.53	.48	.44
6	.61	.51	.44	.59	.50	.43	.48	.43	.39
7	.56	.46	.39	.55	.45	.39	.44	.38	.34
8	.52	.41	.34	.50	.40	.34	.39	.34	.30
9	.47	.37	.30	.46	.36	.30	.35	.30	.26
10	.44	.33	.27	.43	.33	.27	.32	.27	.23

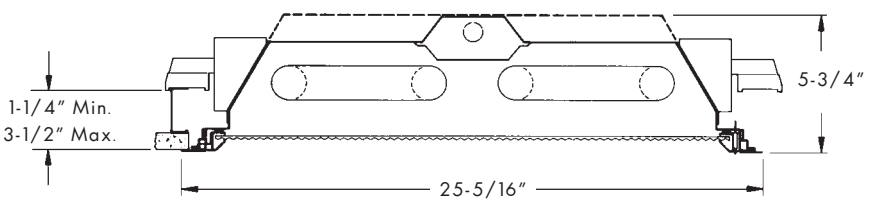
TOTAL LUMINAIRE
OPTICAL **EFFICIENCY** = **81.6 %**
SPACING CRITERIA: ACROSS= 1.3 ALONG= 1.2

BACK VIEW



CROSS SECTION

NEMA TYPE "F" INSTALLATION



MAXIMUM RECOMMENDED CEILING OPENING IS 24-3/8" X 24-3/8"

H.E. WILLIAMS, INC.
H.E. Williams, Inc. • Carthage, Missouri • www.**hewilliams**.com • 417-358-4065 • Fax: 417-358-6015

LITHONIA LIGHTING®

Catalog Number	
Notes	Type: FIXTURE TYPE D1

FEATURES & SPECIFICATIONS

INTENDED USE

Ideal for a wide variety of low- to medium-height ceiling applications including commercial, retail and hospitality spaces where a baffled fixture is required.

OPTICAL SYSTEM

Aluminum full reflectors are optically designed to maximize lumen output and to provide superior glare control. The black or white baffled reflectors have a semi-specular upper finish with a white painted flange standard.

MECHANICAL SYSTEM

Utilizes an extruded socket housing that attaches to the reflector via key hole mount, which provides superior heat dissipation and extended lamp life. Socket housing also adjusts to accommodate varying lamp lengths.

Heavy gauge die formed galvanized steel mounting frame. Attached to frame are vertically adjustable mounting brackets for use with C channels, ½" steel conduit or 16 gauge flat bar hangers included, standard. Frames equipped with galvanized junction box UL Listed for through wire applications. Junction boxes equipped with (2) ¾" and (4) ½" conduit knockouts with pryout slots and removable access doors.

Retaining clips packed with reflector for installation on rough-in.

Maximum 1-1/2" ceiling thickness.

ELECTRICAL SYSTEM

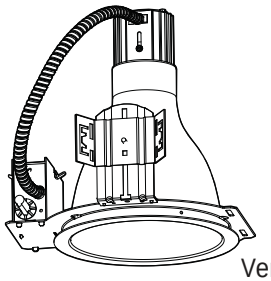
Durable medium-base porcelain socket with nickel-plated copper alloy screw shell and contact. Integral thermal protector provides protection against improper use of insulation materials.

Rated for No. 12 AWG conductor thru-branch wiring. Mimimum 90° supply wire.

Ground wire provided.

LISTING

Fixtures are UL Listed for thru-branch wiring, Non-IC recessed mounting, damp location, and to U.S. and Canadian Safety Standards.

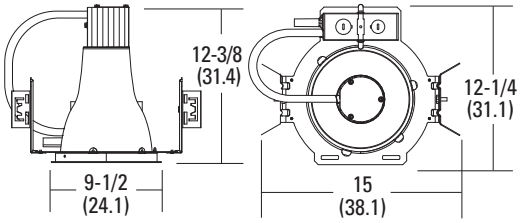


Incandescent Downlighting

8" LP8N

BAFFLE

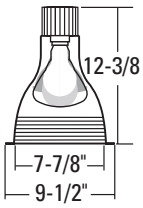
Vertical – A19, A23, PS25, PAR38 or BR40



Specifications

Max. Height: 12-3/8 (31.4)
Ceiling Opening: 8-3/4 (22.2)
Overlap Trim: 9-1/2 (24.1)
Length: 15 (38.1)
Width: 12-1/4 (31.1)

All dimensions are inches (centimeters).



ORDERING INFORMATION

For shortest lead times, configure product using **standard options (shown in bold).**
Example: LP8N 8B3

LP8N

Series	Reflector/Color[2]	Options
LP8N[1]	**8B3 Black baffle** **8B3W White baffle**	SDT 277V stepdown transformer (277V or to 120V). LBH Less Barhangers

NOTES:

1 Refer to label included with reflector for lamp type and maximum wattage availability.

2 White painted flange standard.

Lamp Max. Wattages

Max. wattage	Lamp type
200W	A
200W	PS25
250W	Par38
250W	BR40

Accessories

Order as separate catalog number

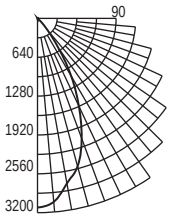
SCA8 Sloped ceiling adaptor. Degree of slope must be specified (10D, 15D, 20D, 25D, 30D) Ex: SCA8 10D.

CTE8 Ceiling thickness extender is used when ceiling thickness is greater than 1-1/2 (3.8). Maximum thickness 2 (5.1).

8” **LP8N** Vertical – A19, A23, PS25, PAR38 or BR40, Baffle

Distribution Curve | **Distribution Data** | **Output Data** | **Coefficient of Utilization** | **Illuminance Data at 30” Above Floor for a Single Luminaire**

LP8N 8B3, (1) 200W A23 lamp, .87 s/mh, 3930 rated lumens, test no. LTL9955



From 0°	cp.
0°	3116
5°	3037
15°	2525
25°	1592
35°	593
45°	99
55°	5
65°	3
75°	2
85°	1
90°	0

Zone	Lumens	%lamp
0°-30°	1699	43.2
0°-40°	2082	53.0
0°-60°	2169	55.2
0°-90°	2175	55.3
90°-180°	0	0.0
0°-180°	2175	55.3*

* Efficiency

rf	20%					
rc	80%		70%		50%	
rw	50%	30%	50%	30%	50%	30%
0	.66	.66	.64	.64	.61	.61
1	.62	.60	.60	.59	.58	.57
2	.58	.55	.57	.55	.55	.53
3	.54	.51	.53	.51	.52	.50
4	.51	.48	.50	.47	.49	.47
5	.48	.45	.47	.44	.46	.44
6	.45	.42	.45	.42	.44	.41
7	.43	.39	.42	.39	.42	.39
8	.40	.37	.40	.37	.39	.37
9	.38	.35	.38	.35	.38	.35
10	.36	.33	.36	.33	.36	.33

		50% Beam angle 43.2°		10% Beam angle 70.5°	
Mount height	Initial fc at beam center	Beam diameter	fc at beam edge	Beam diameter	fc at beam edge
8'	103.0	4.4'	51.5	7.8'	10.3
10'	55.4	5.9'	27.7	10.6'	5.5
12'	34.5	7.5'	17.3	13.4'	3.5
14'	23.6	9.1'	11.8	16.2'	2.4
16'	17.1	10.7'	8.5	19.1'	1.7

LITHONIA LIGHTING®
An AcuityBrands Company

Sheet #: LP8N-BAFFLE

Lithonia Lighting
Recessed Downlighting and Track
One Lithonia Way, Conyers, GA 30012
Phone: 800-315-4935 Fax: 770-918-1209
www.lithonia.com

COMPACT FLUORESCENT INDICATOR LIGHT

PL-COPY

SUBMITTAL:

JOB:

TYPE: FIXTURE TYPE E1&E2 **VOLTAGE:**

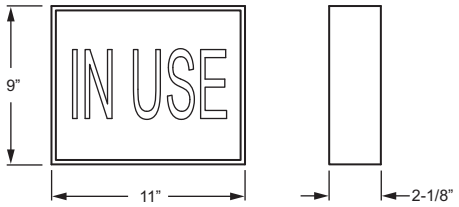
IN USE

EXAMPLE **PL-COPY - SF - (2) 13WPL - OPTIONS - EB2 - 120**

SERIES	MESSAGE COPY	NUMBER OF SIDES	NUMBER OF LAMPS	WATTAGE/ TYPE	OPTIONS	BALLAST TYPE	VOLTAGE
PL	COPY	SF	(2)	13WPL	OPTIONS	EB2	120

FEATURES

- Available with choice of message–consult factory for custom orders.
- Red on white lettering standard–consult factory for custom colors.
- Available single-faced or double-faced.
- Universal mount canopy included for easy installation on wall or ceiling.
- This fixture is proudly made in the USA.



ORDERING INFORMATION

SERIES

PL	Compact Fluorescent Indicator Light

MESSAGE COPY

Consult factory for custom message.

ARA	Area of Rescue Assistance
BO	Beam On
CLOS	Closed
DIU	Darkroom in Use
DR	Darkroom
OCC	Occupied
OTA	On the Air
OPE	Open
RIU	Room in Use
XIU	X-Ray in Use

NUMBER OF SIDES

SF	Single face
DF	Double face

LAMP OPTIONS

# OF LAMPS	WATTAGE/TYPE
(2)	13WPL

OPTIONS

Consult factory for custom color.

BALLAST TYPE

EB2	2-lamp electronic ballast

VOLTAGE (Must specify)

120	120V
277	277V

SPECIFICATIONS

Housing – Extruded aluminum.
Housing Finish – Textured matte white polyester TGIC powder coat bonded to phosphate-free, multi-stage pretreated metal.
Electrical – Electronic ballast standard with compact fluorescent lamps. Prewired at factory for easy field installation. Must specify voltage (120V or 277V).
Mounting – Surface mount on wall or ceiling with universal canopy.
Labels – UL/CUL listed for dry or damp locations.

Williams DOWNLIGHTING
H.E. Williams, Inc. ■ Carthage, Missouri ■ www.**hewilliams**.com ■ 417-358-4065 ■ Fax: 417-358-6015

DUAL LITE

FIXTURE TYPE X

LE Series

Architectural Recessed-Mounted LED Edge-Lit Exit Sign

Catalog Number	
Comments	Type

FEATURES

Application

The LE Series provides bright, even letter illumination in an energy-saving LED edge-lit exit sign configuration. AC or Emergency operation with optional Spectron® self-test/self-diagnostic circuitry. Special Wording ("SW") option allows customizing the stencil field to convey important information.

Construction

Water-clear injection-molded acrylic EXIT plaque is available with clear, white or mirror backgrounds. High strength extruded aluminum trim available in six finishes. Exit face design in single or double face with red or green letters. Custom printed directional chevron arrows. Standard EXIT stencil with 6" letters and ¾" stroke; 8" letters for New York City requirements available as an option. Rough-in kit: galvanized steel, .036 (20 Ga.) housing, .060 (16 Ga.) mounting bars.

Installation

Universal rough-in box accommodates recessed installation of all models in wall, ceiling or end-mount applications. All mounting hardware is fully concealed.

Illumination

Exit face illumination is provided by energy saving, long life red or green LEDs. Exceeds UL 924 requirements for brightness and uniformity. 10 year LED life.

Compliances

UL 924 Listed
NFPA 70
NFPA 101

Ceiling Mount

NEMA Premium

Wall Mount

End Mount

Special Wording Option

Warranty

AC models: 5 years full.
Emergency models: 5 years on unit and electronics. Battery: 1 year full, 9 year pro-rata.
Spectron-equipped models: 5 years on unit and electronics, lifetime warranty on battery.

ORDERING GUIDE

LE	C	S	R	X	N	E	I	-FAP
Model	Mounting	Faces	Letter Color	Directional Arrows	Trim/Housing Finish	Operation	Self-Diagnostic	Options
	C - Ceiling mount **W** - Wall mount **E** - End mount	**S** - Single **D** - Double* * Not for use with wall mounted models	**R** - Red **G** - Green	**X** - No arrows **EXIT** **R** - Right arrow* **EXIT>** **L** - Left arrow* **<EXIT** **D** - Double arrows **<EXIT>** **C** - L/R arrows** **<EXIT/EXIT>** * Not for use with double face models. Use "C" L/R arrow designator. ** Double face models only. Provides reversible right or left arrow indicator.	**N** - Satin Aluminum **W** - White **C** - Chrome **B** - Black **S** - Satin Brass **Z** - Dark Bronze	**A** - AC only **E** - Emergency	**Blank** - None **I** - Spectron self-testing/ self-diagnostic electronics* * For use with emergency models only	See "Options" section

OPTIONS

-2C	2-circuit operation [2,5]
-FAP	Fire alarm panel interface [3,5,6]
-FM	Flasher module [1,6]
-AF	Audible flasher module [1,6]
-DC	Remote DC operation [2,4,5]
-24K	220-240VAC, 60Hz. operation [9]
-XK	Recessed mount exit sign less rough-in kit [7,9]
-W	White plaque background
-M	Mirror-plaque background [8]
-8L	8 inch letter plaque (red letters only) [10,11]
-SW	See available special wording choices on page 3 [12,13,14]

ACCESSORIES *(order separately)*

URK	Universal rough-in kit
URK2C	Universal 2-circuit rough-in kit [a,b,c]

[a] For use with AC models only.
[b] Rough-in kit may not be ordered separately on models specified with -24K option.
[c] Must be ordered in conjunction with -2C option on exit sign

To Order Rough-In Kit Separately

To order rough-in kit only for field installation, add "-XK" option suffix to exit model number and order "URK" or "URK2C" kit separately.

[1] For use with emergency models only.
[2] For use with AC models only.
[3] Operates with 24-volt AC or DC fire alarm panels.
[4] For emergency illumination of sign from remote 6-24VDC power sources.
[5] -DC option may not be specified with -2C or -FAP options.
[6] -AF, -FM and -FAP options may not be specified together.
[7] Allows ordering of rough-in kit separately for recessed mount (LE) models. See "Accessories".
[8] For use with single face models only. Standard on double face models.
[9] Rough-in kit may not be ordered separately on models specified with -24K option.
[10] LE exit models with 8" plaques registered under NY-BEC Calendar number 42135 for use in New York City.
[11] Single face LE exit signs specified with the -8L option are supplied without backgrounds. Double face models specified with the -8L option are supplied with mirror backgrounds.
[12] Specify special wording code from page 3 when ordering. Example: SW41
[13] Special wording option not available with 8" letter plaque.
[14] Some special wording signs not available with directional arrows.

HUBBELL®
Hubbell Lighting, Inc.

LE Series

Architectural Recessed-Mounted LED Edge-Lit Exit Sign

SPECIFICATIONS

Electronics

Available with AC, emergency and Spectron® self-test/self-diagnostic electronics option. Emergency and self-diagnostic models equipped with isolation transformer and fully automatic constant current solid state charger with sealed maintenance-free nickel-cadmium battery. All emergency models with 90-minute run-time. All components mounted inside housing. Includes test switch and AC-on indicator. Transient/surge protection, low voltage disconnect and AC lock-out features included. Battery re-charge within UL time standards. Includes pre-stripped AC input pigtail leads.

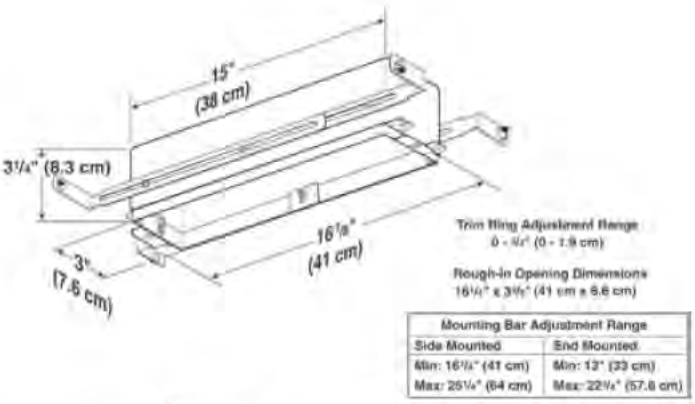
Power Consumption (120/277VAC)

	Single Face	Double Face
Red AC Only Models:	2.2 watts	3.4 watts
Green AC Only Models:	2.5 watts	4.0 watts
Red Emergency Models:	3.3 watts	4.5 watts
Green Emergency Models:	3.6 watts	5.0 watts

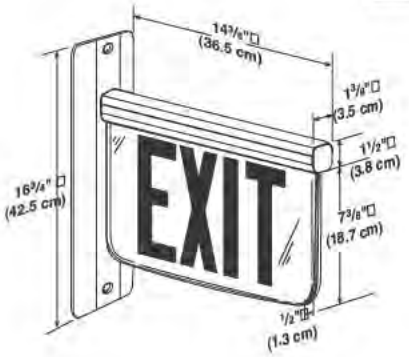
**Wattage figures include LED lamps, transformer and electronics power requirements.*

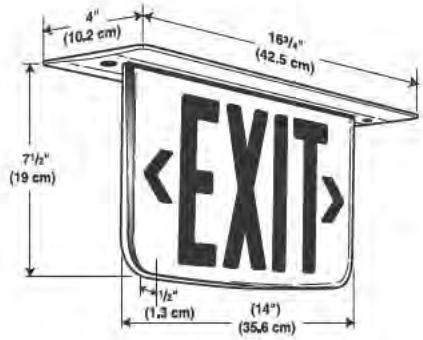
Power Factor, Average: .8 (lagging)
Battery Type: Maintenance-free sealed nickel cadmium battery
AC Input: 120/277VAC, 60 Hz. (all models)
Operating Temperature Range: 20°C to 30°C (68°F to 86°F)

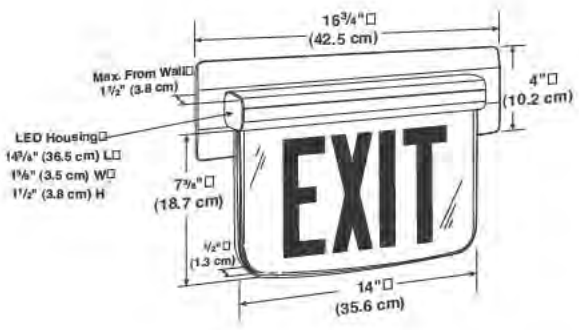
DIMENSIONS



Mounting Bar Adjustment Range	
Side Mounted	End Mounted
Min: 16⅛" (41 cm)	Min: 13" (33 cm)
Max: 25¼" (64 cm)	Max: 22⅛" (57.8 cm)







Hubbell Lighting, Inc.

LE Series

Architectural Recessed-Mounted LED Edge-Lit Exit Sign

LE Series architectural recessed LED edge-lit exit signs feature an option for standard or custom special-wording. The images below represent standard special-worded signs available for the LE Series. The artwork and silk-screening for the standard signs shown below were previously developed therefore pricing for these special-worded signs do not incur a setup charge.

If your special-worded requirements do not appear on this page, please contact the factory to request your custom special-wording sign. Custom special wording signs incur a one time set-up charge for each development.

STANDARD SPECIAL WORDING SIGNS WITH DIRECTIONAL ARROWS

SW118

SW41 (Arabic/Exit)

SW13

SW10

SW69

SW11

STANDARD SPECIAL WORDING SIGNS WITHOUT DIRECTIONAL ARROWS

SW4

SW3

SW31

SW2

Hubbell Lighting, Inc.
0601633 C 11/11

APPENDIX E

PLUMBING

American Standard
Style That Works Better

ROXALYN™ WALL-HUNG LAVATORY
VITREOUS CHINA

ROXALYN™ WALL-HUNG LAVATORY

- Wall-hung sink
- Vitreous china
- Front overflow
- Faucet ledge
  Shown with 7401.172H Amarilis Heritage faucet with Wrist Blade handles (not included)
- Designed for off-wall installation with 2" clearance from wall

Faucet holes on 203mm (8") centers:

❑ **0194.019** For exposed bracket support

❑ **0194.076** For concealed arms support

Faucet holes on 102mm (4") centers (Illus.):

❑ **0195.016** For exposed bracket support

❑ **0195.073** For concealed arms support

Single faucet hole on right:

❑ **0194.035** For exposed bracket support

❑ **0194.092** For concealed arms support

Single center faucet hole:

❑ **0194.225** For exposed bracket support

❑ **0194.043** For concealed arms support

Nominal Dimensions:
508 x 457mm
(20" x 18")

Bowl sizes:
362mm (14-1/4") wide
273mm (10-3/4") front to back
178mm (7") deep

Compliance Certifications -
Meets or Exceeds the Following Specifications:
- ASME A112.19.2 for Vitreous China Fixture

SEE REVERSE FOR ROUGHING-IN DIMENSIONS

To Be Specified:
- ❑ Color: ❑ White ❑ Bone ❑ Silver
- ❑ Faucet*:
- ❑ Faucet Finish:
- ❑ Supplies:
- ❑ 1-1/4" Trap:
- ❑ Nipple:
- ❑ Bracket Support (if required):
  - ❑ 485742-600: 381mm (15") painted bracket
- ❑ Concealed Arms Support (by others):

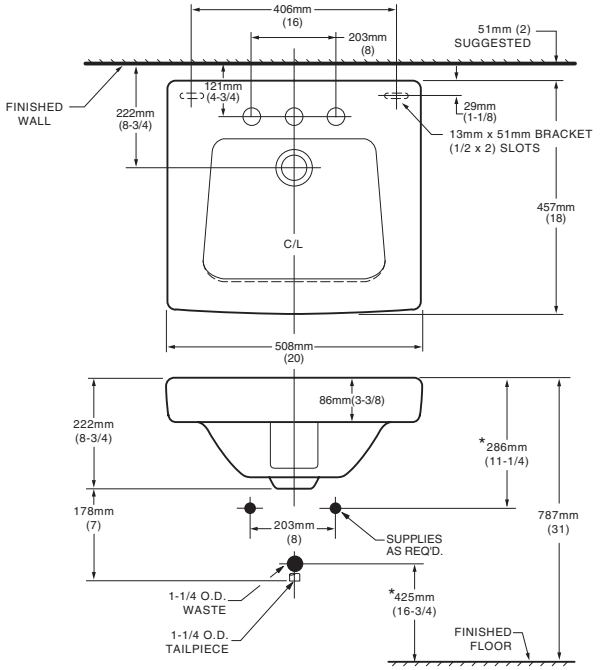
* See faucet section for additional models available

Revised 8/05

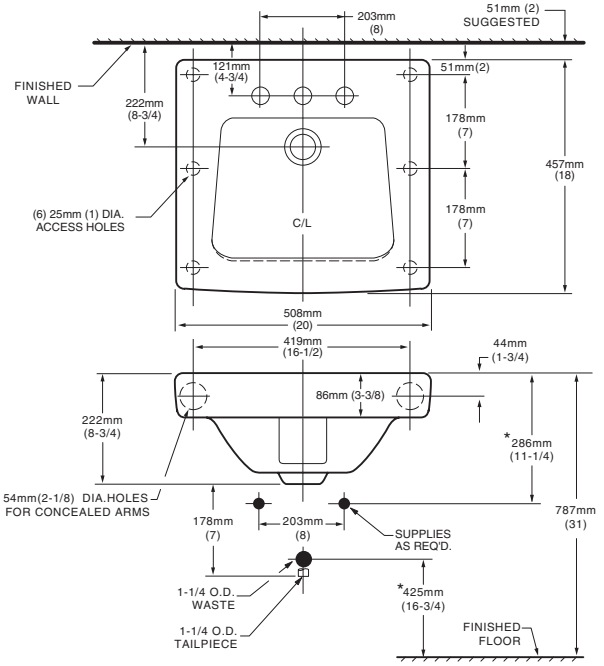
American Standard
Style That Works Better

ROXALYN™ WALL-HUNG LAVATORY
VITREOUS CHINA

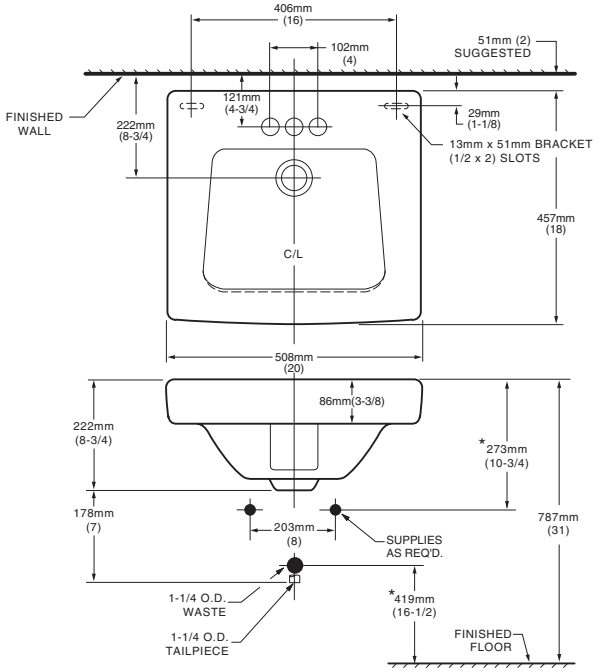
0194.019 EXPOSED BRACKET SUPPORT VARIATIONS



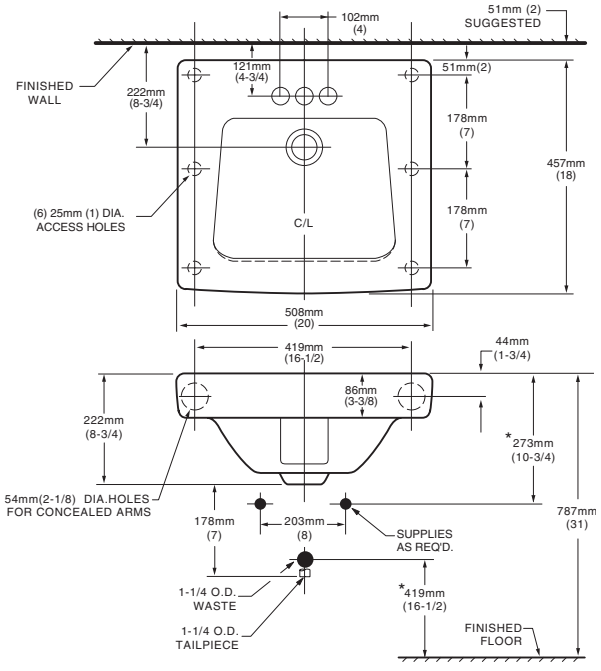
0194.076 CONCEALED ARMS SUPPORT VARIATIONS



0195.016



0195.073

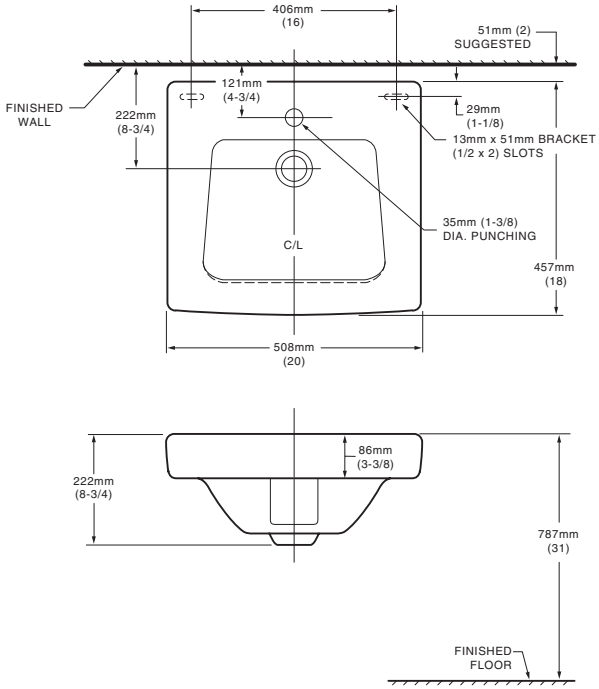


IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

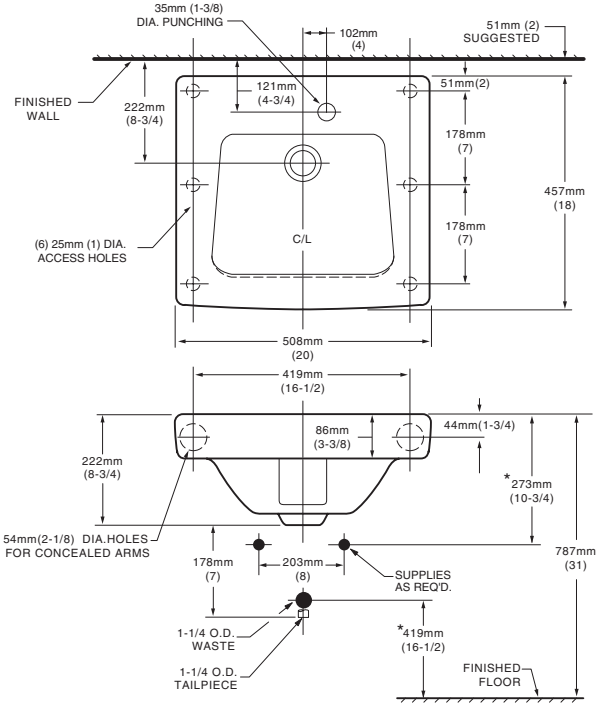
NOTES:
***** DIMENSIONS SHOWN FOR LOCATION OF SUPPLIES AND “P” TRAP ARE SUGGESTED.
SHOWN WITH CENTERSET FTG. OR COMB. FTG., FLEX SUPPLIES, POP-UP DRAIN & 1-1/4" O.D. “P” TRAP.
FITTINGS NOT INCLUDED AND MUST BE ORDERED SEPARATELY.
PROVIDE SUITABLE REINFORCEMENT FOR ALL WALL SUPPORTS.
CONCEALED ARMS SUPPORT & EXPOSED BRACKET SUPPORT TO BE FURNISHED BY OTHERS.

ROXALYN™ WALL-HUNG LAVATORY
VITREOUS CHINA

0194.225 EXPOSED BRACKET SUPPORT VARIATION



0194.092 CONCEALED ARMS SUPPORT VARIATION



NOTES:
***** DIMENSIONS SHOWN FOR LOCATION OF SUPPLIES AND “P” TRAP ARE SUGGESTED.
FITTINGS NOT INCLUDED AND MUST BE ORDERED SEPARATELY.
PROVIDE SUITABLE REINFORCEMENT FOR ALL WALL SUPPORTS.
CONCEALED ARMS SUPPORT & EXPOSED BRACKET SUPPORT TO BE FURNISHED BY OTHERS.

IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

American Standard
Style That Works Better

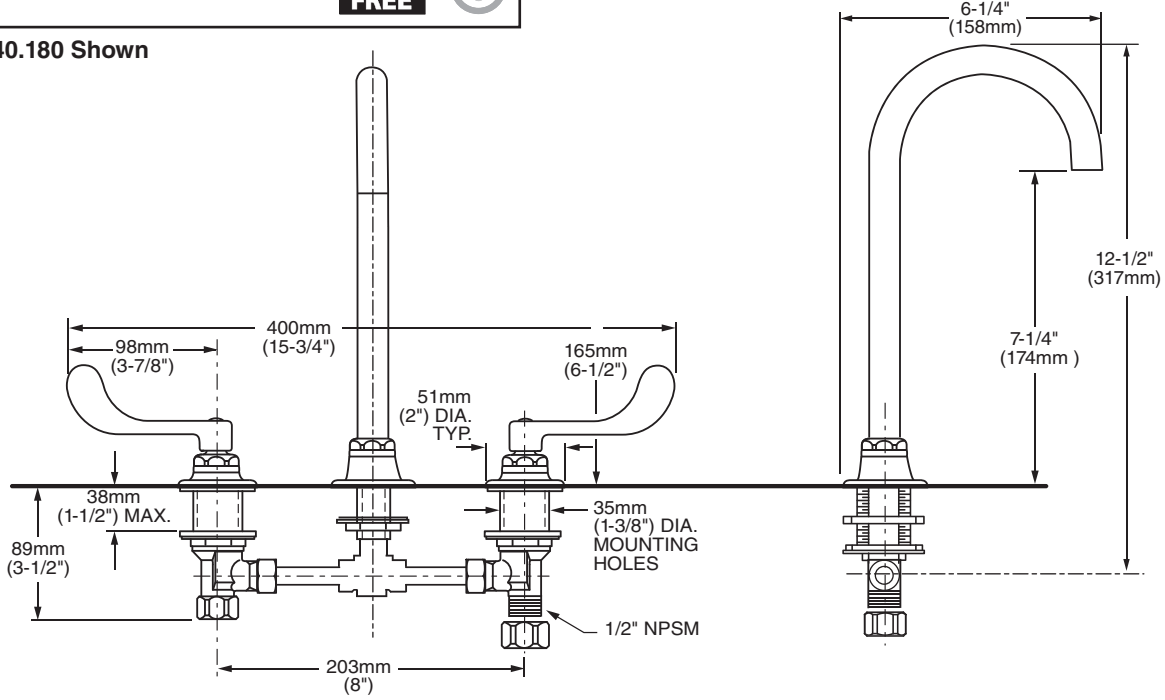
MONTERREY™

WITH LAMINAR FLOW IN BASE OF SPOUT TWO-HANDLE 8" WIDESPREAD LAVATORY FAUCET WITH RIGID/SWIVEL GOOSENECK SPOUT

6540.180 Shown

MODEL NUMBER:

❑ **6540.180 Widespread Lavatory**
1.5 gpm Pressure Compensating Laminar Flow device in base of spout. Field-Convertible rigid/swivel gooseneck spout. Plain spout end. Vandal-Resistant Wrist Blade Handles. Less drain and pop-up hole.



GENERAL DESCRIPTION:

Durable cast brass construction. Cast brass valve bodies with 8" rigid copper connection with compression fittings. 1/2" male threaded inlet shanks with brass coupling nuts. 1/4 turn ceramic disc valve cartridges. Field-Convertible rigid/swivel spout. Plain spout end. Vandal-Resistant Wrist Blade handles with blue & red color indexes. 1.5 gpm/5.7L/min. maximum flow rate.

PRODUCT FEATURES:

Laminar Flow Device in Base of Spout: Ideal for hospital applications.

Solid Brass Construction: Durable - Excellent in high use applications. Ideal for prolonged contact with water.

Ceramic Disc Valve Cartridges: Assures a lifetime of drip-free performance.

Field-Convertible Rigid/Swivel Spout: Easily converted in the field.

Lead Free: Faucet contains ≤ 0.25% total lead content by weighted average.

SUGGESTED SPECIFICATION:

Two handle widespread lavatory faucet shall feature cast brass valve bodies with 8" rigid copper connection. Shall feature water-conserving 1.5 gpm/5.7L/min. pressure compensating laminar flow device in base of spout. Vandal-Resistant wrist blade handles. 1/4 turn washerless ceramic disc valve cartridges. Shall also feature field-convertible rigid/swivel spout with plain spout end. Fitting shall be American Standard Model # 6540.180.002.

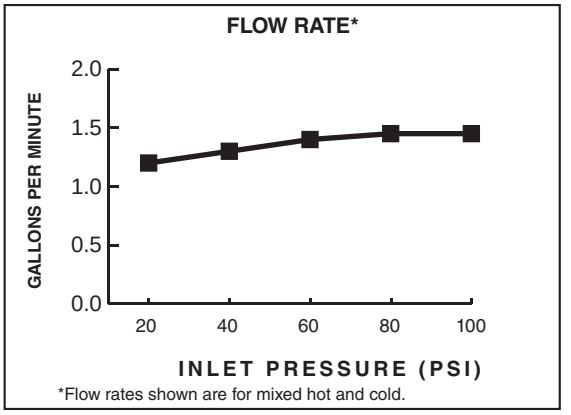
MONTERREY™

WITH LAMINAR FLOW IN BASE OF SPOUT TWO-HANDLE 8" WIDESPREAD LAVATORY FAUCET WITH RIGID/SWIVEL GOOSENECK SPOUT

CODES AND STANDARDS

These products meet or exceed the following codes and standards:

ANSI 117.1
ASME A112.18.1
CSA B 125
NSF 61/Section 9 and Annex G



*Flow rates shown are for mixed hot and cold.

Product Number	Description	Finish: Polished Chrome 002
6540.180	Widespread Lavatory with field-convertible rigid/swivel gooseneck spout. 1.5 gpm/5.7L/min pressure compensating laminar flow device in base of spout. Plain spout end. Vandal-Resistant Wrist Blade Handles. Less drain and pop-up hole.	

MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 REQUIREMENTS FOR ACCESSIBLE AND USABLE BUILDING FACILITIES-CHECK LOCAL CODES

ELKAY®
SPECIFICATIONS

Gourmet® Single Bowl Sink
Models LR, LRQ, LRS and LRSQ Series

GENERAL
Highest quality sink formed of #18 (1.2mm) gauge, type 304 (18-8) nickel bearing stainless steel. Top mount.

DESIGN FEATURES
LR(Q) Bowl Depth: 8" (203mm) (LR[Q]2521), 7-1/2" (191mm) (LR[Q]1919), 7-5/8" (194mm) (all others).

Coved Corners: 1-3/4" (44mm) vertical and horizontal radius.

Bowl and Faucet Deck Recess: 3/16" (5mm) below outside edge of sink.

Finish: Exposed surfaces are hand blended to a lustrous satin finish.

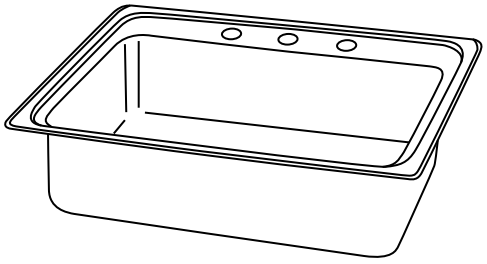
Underside: Fully undercoated to dampen sound and prevent condensation. LR(Q)2521 is fully protected by heavy duty Sound Guard® undercoating.

OTHER
Drain Opening: 3-1/2" (89mm).

NOTE: Unless otherwise specified, models with one, two, three or OS4 faucet hole option are furnished with 3 faucet holes as shown; models with choice of one, two, three, four or five faucet hole option are furnished with 4 faucet holes standard.

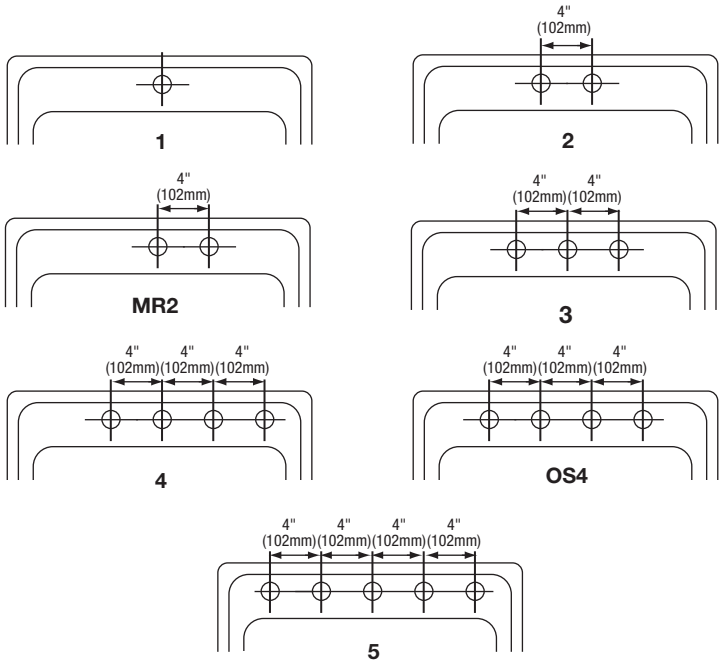
These sinks comply with ASME A112.19.3.

These sinks are listed by the International Association of Plumbing and Mechanical Officials as meeting the requirements of the Uniform Plumbing Code.

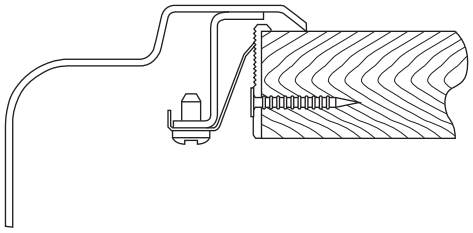


Model LR(Q)22193

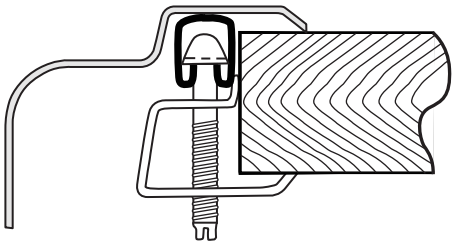
HOLE DRILLING CONFIGURATIONS



Quick-Clip® Mounting System



U-Channel Type Mounting System



In keeping with our policy of continuing product improvement, Elkay reserves the right to change product specifications without notice. Please visit elkayusa.com for most current version of Elkay product specification sheets.

This specification describes an Elkay product with design, quality and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

Elkay
elkayusa.com

2222 Camden Court
Oak Brook, IL 60523

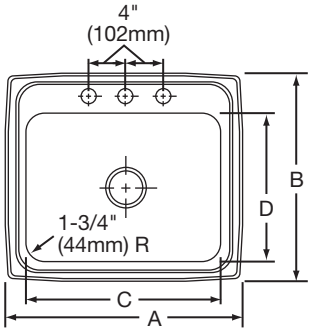
Gourmet® Single Bowl Sink
Models LR, LRQ, LRS and LRSQ Series

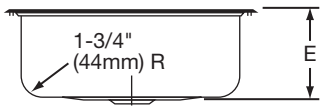
ELKAY®
SPECIFICATIONS

SINK DIMENSIONS*

U-Channel Model Number	Quick-Clip® Model Number	Overall L A	Overall W B	Inside Bowl L C	Inside Bowl W D	Inside Bowl D E	Cutout in Countertop [1 1/2" (38mm) Radius Corners] L	Cutout in Countertop [1 1/2" (38mm) Radius Corners] W	No. of 1 1/2" (38mm) Dia. Faucet Holes 4" (102mm) Center	Minimum Cabinet Size
LR1316	**LRQ1316**	13 (330mm)	16 (406mm)	10 (254mm)	10 (254mm)	7 5/8 (194mm)	12 3/8 (321mm)	15 3/8 (391mm)	1, 2, MR2 or 3	18 (457mm)
LR1517	**LRQ1517**	15 (381mm)	17 1/2 (445mm)	12 (305mm)	12 (305mm)	7 5/8 (194mm)	14 3/8 (371mm)	16 7/8 (429mm)	1, 2, MR2 or 3	18 (457mm)
LR1522	**LRQ1522**	15 (381mm)	22 (559mm)	11 1/2 (292mm)	16 (406mm)	7 5/8 (194mm)	14 3/8 (371mm)	21 3/8 (543mm)	1, 2, MR2 or 3	18 (457mm)
LR1716	**LRQ1716**	17 (432mm)	16 (406mm)	14 (356mm)	10 (254mm)	7 5/8 (194mm)	16 3/8 (422mm)	15 3/8 (391mm)	1, 2, MR2, 3 or OS4	21 (533mm)
LR1720	**LRQ1720**	17 (432mm)	20 (508mm)	14 (356mm)	14 (356mm)	7 5/8 (194mm)	16 3/8 (422mm)	19 3/8 (492mm)	1, 2, MR2, 3 or OS4	21 (533mm)
LR1722	**LRQ1722**	17 (432mm)	22 (559mm)	13 1/2 (343mm)	16 (406mm)	7 5/8 (194mm)	16 3/8 (422mm)	21 3/8 (543mm)	1, 2, MR2, 3 or OS4	21 (533mm)
LR1918	**LRQ1918**	19 (483mm)	18 (457mm)	16 (406mm)	11 1/2 (292mm)	7 5/8 (194mm)	18 3/8 (467mm)	17 3/8 (441mm)	1, 2, MR2, 3 or OS4	24 (610mm)
LR1919	**LRQ1919**	19 1/2 (495mm)	19 (483mm)	16 (406mm)	13 1/2 (343mm)	7 1/2 (190mm)	18 7/8 (479mm)	18 3/8 (467mm)	1, 2, MR2, 3 or OS4	24 (610mm)
LR2022	**LRQ2022**	19 1/2 (495mm)	22 (559mm)	16 (406mm)	16 (406mm)	7 5/8 (194mm)	18 7/8 (479mm)	21 3/8 (543mm)	1, 2, MR2, 3 or OS4	24 (610mm)
LR2219	**LRQ2219**	22 (559mm)	19 1/2 (495mm)	18 (457mm)	14 (356mm)	7 5/8 (194mm)	21 3/8 (543mm)	18 7/8 (479mm)	1, 2, MR2, 3, 4 or 5	27 (686mm)
LR2222	**LRQ2222**	22 (559mm)	22 (559mm)	19 (483mm)	16 (406mm)	7 5/8 (194mm)	21 3/8 (543mm)	21 3/8 (543mm)	1, 2, MR2, 3, 4 or 5	27 (686mm)
LR2521	**LRQ2521**	25 (635mm)	21 1/4 (540mm)	21 (533mm)	15 3/4 (400mm)	8 (203mm)	24 3/8 (619mm)	20 5/8 (524mm)	1, 2, MR2, 3, 4 or 5	30 (762mm)
LR3122	**LRQ3122**	31 (787mm)	22 (559mm)	28 (711mm)	16 (406mm)	7 5/8 (194mm)	30 3/8 (772mm)	21 3/8 (543mm)	1, 2, MR2, 3, 4 or 5	36 (914mm)
LRS3322	**LRSQ3322**	33 (838mm)	22 (559mm)	28 (711mm)	16 (406mm)	7 5/8 (194mm)	32 3/8 (822mm)	21 3/8 (543mm)	1, 2, MR2, 3, 4 or 5	36 (914mm)

*Length is left to right. Width is front to back.





LRQ Series Illustrated

2222 Camden Court
Oak Brook, IL 60523
www.elkayusa.com

ELKAY®

SPECIFICATIONS

Exposed Deck Mount 8" Center Commercial Faucet
Models LK810AT08L2, LK810AT08T4, LK810AT08T6

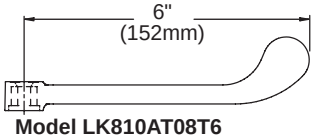
FEATURES

Model LK810AT08L2
- Three hole dual handle top mount faucet
- Quarter turn ceramic disc cartridge
- Solid brass construction
- Chrome finish
- Includes spout swing restriction pin

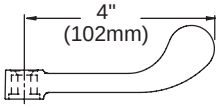
Model LK810AT08T4
- Same as LK810AT08L2 except with 4" wrist blades handles

Model LK810AT08T6
- Same as LK810AT08L2 except with 6" wrist blades handles

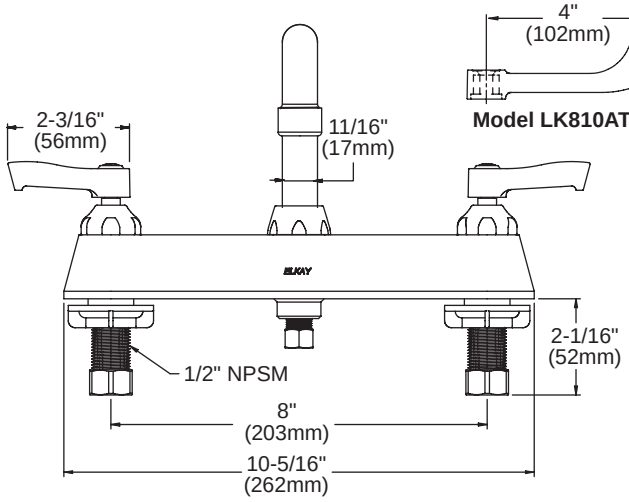
COMPLIES WITH:
- ASME/ANSI A112.18.1
- CSA B125-01
- NSF/ANSI 61
- ADA
- UPC/CUPC
- IAPMO Listed



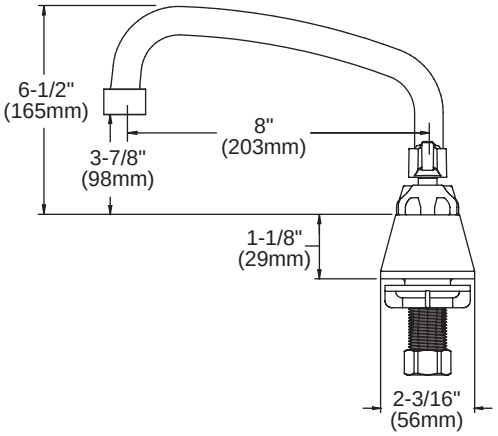
Model LK810AT08T6



Model LK810AT08T4



Model LK810AT08L2
FRONT VIEW



SIDE VIEW

Job Name:	**Item #:**
Notes:	
Architect/Engineer Approval:	**Date:**

SEE OTHER SIDE FOR REPLACEMENT PARTS

Elkay
elkayusa.com

2222 Camden Court, Oak Brook, IL 60523
1-630-574-8484 Fax: 1-630-574-4509

Triple Zone Valve and Box Assembly

SPECIFICATION

Triple Zone Valve and Box Assembly

Valves shall be full port, double seal, ball-type with three piece bronze/brass body and a chrome plated brass ball. Valves shall be designed for a maximum working pressure of 600 psig WOG or vacuum service to 29" Hg. Valve body shall have reinforced PTFE ball seat and reinforced PTFE stem seals, and stem shall be blowout proof. All valve materials shall be compatible with USP oxygen, nitrous oxide, medical air, carbon dioxide, helium, nitrogen, argon and mixtures thereof. A 1/4 turn of the handle shall be required to operate the valve from OPEN to CLOSED position. The valve shall be securely attached to the box and provided with type K copper tube extensions for making connection to system piping outside the box. All valves shall be serviceable in the line, supplied clean and prepared for oxygen service. All zone valve assemblies shall include a 1/8" NPT port with pipe plug as a provision for connection of a gauge. The gauge port is located on the terminal outlet side of the valve to register pipeline pressure or vacuum. The gauge shall be visible through the door of the zone valve box. The zone valve and box assembly shall meet all requirements of NFPA 99 and CAN/CSA Z305.1. The valves conform to MSS SP-110. Type K copper tube extensions conform to ASTM B88, UNS No. C12200, and H58 temper. The gauges conform to ANSI B40.1.

Triple Zone Box Design

The zone valve box shall be constructed of 18 gauge steel with white epoxy finish and provided with two galvanized steel brackets that anchors the box to the wall. Anchor brackets shall be designed to permit box assemblies to be ganged together in a vertical stack. Triple valve box assemblies require a rough wall opening of sufficient size to accomodate a nominal 11-7/8" wide x 15-1/2" high x 3-7/8" deep box. The 2-1/2" and 3" valves require a rough wall opening of 15-7/8" wide x 10" high x 6-11/16" deep. The zone valve box assembly shall have a sliding, opaque door with pull ring and clear gauge window. The door shall be capable of sliding to the right or left to facilitate installation requirements. In an emergency, the door shall SNAP OUT by pulling the pull ring forward without exposing sharp edges. The zone valve box shall be provided with an anodized aluminum trim capable of adjusting to variations in wall thickness up to 1" below flush. The zone valve box assembly shall be supplied with color coded gas identification labels. The assembly door shall have a label that reads:

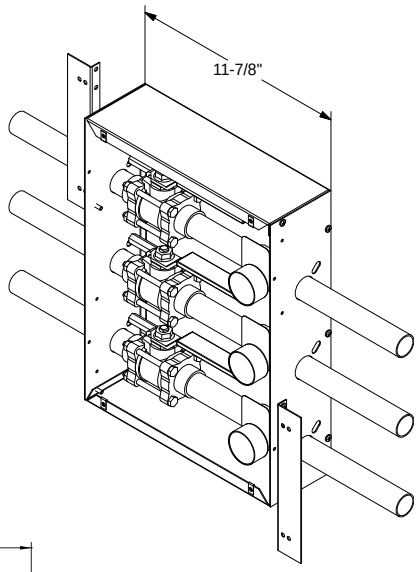
-CAUTION-
MEDICAL GAS SHUT-OFF VALVES
CLOSE ONLY IN EMERGENCY

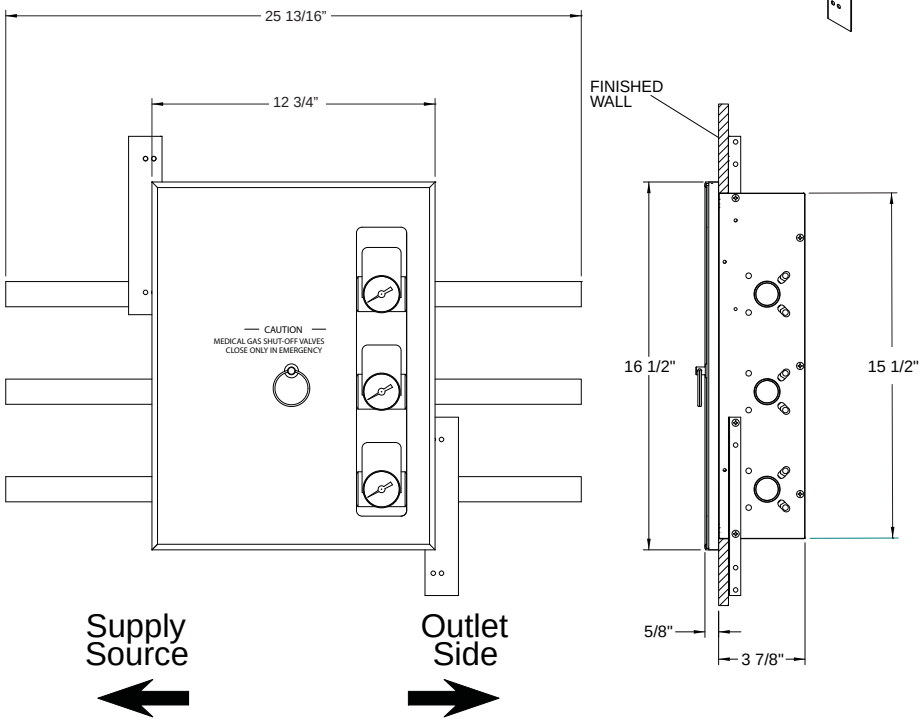
	Valve Size	Complete Assembly	Valve Size	Complete Assembly	Note:
Zone Valve Box Assembly	Empty, large	☐ 150300-00	½" x1" x 1½"	☐ 150312-00	All zone valve box assemblies include 1/8" NPT gauge port/ plug for each valve and two labels each for the following services: Oxygen, Nitrous Oxide, Medical Air, Nitrogen, Vacuum, WAGD, Carbon Dioxide, and Instrument Air.
	½" x ½" x ½"	☐ 150301-00	¾" x ¾" x ¾"	☐ 150313-00	
	½" x ½" x ¾"	☐ 150302-00	¾" x ¾" x 1"	☐ 150314-00	
	½" x ½" x 1"	☐ 150303-00	¾" x ¾" x 1¼"	☐ 150315-00	
	½" x ½" x 1¼"	☐ 150304-00	¾" x ¾" x 1½"	☐ 150316-00	
	½" x ½" x 1½"	☐ 150305-00	¾" x 1" x 1"	☐ 150317-00	
	½" x ¾" x ¾"	☐ 150306-00	¾" x 1" x 1¼"	☐ 150318-00	
	½" x ¾" x 1"	☐ 150307-00	¾" x 1" x 1½"	☐ 150319-00	
	½" x ¾" x 1¼"	☐ 150308-00	1" x 1" x 1"	☐ 150320-00	
	½" x ¾" x 1½"	☐ 150309-00	1" x 1" x 1¼"	☐ 150321-00	
	½" x1" x 1"	☐ 150310-00	1" x 1" x 1½"	☐ 150322-00	
	½" x1" x 1¼"	☐ 150311-00			
Gauges[1]	Type	Part Number	System		
	0-30" Hg	☐ 130107-00	Vacuum, WAGD		
	0-100 psig	☐ 130108-00	O_2, Air, N_2O, CO_2 & Mixtures		
	0-300 psig	☐ 130109-00	Nitrogen, Instrument Air, O_2 (100 psig), Air (100 psig), CO_2 (100 psig)		
Smoked Finish Door Assembly[2]		☐ 232173-SM			

Note: 1. Order gauges separately for zone valve application.

2. Smoked door is an additional cost and will ship loose for customer to replace.

Triple Zone Valve and Box Assembly





Additional Labels: One Set per Package			Additional Labels: 20 Labels per Package		
☐	430259-00	One Each: Oxygen, Nitrous Oxide, Medical Air, Vacuum, Nitrogen, WAGD, Carbon Dioxide, Instrument Air	☐	435000-21	Carbon Dioxide-Oxygen Mixture (CO_2 over 7.5%)
☐	435674-00	One Each: Oxygen, Nitrous Oxide, Air, Vacuum, Nitrogen (ISO)	☐	435000-22	Oxygen-Carbon Dioxide Mixture (CO_2 not over 7.5%)
			☐	435000-23	Helium-Oxygen Mixture (He over 80.5%)
			☐	435000-24	Oxygen-Helium Mixture (He not over 80.5%)
			☐	435000-25	Helium
			☐	435000-28	Oxygen (100 psig)
			☐	435000-29	Medical Air (100 psig)
			☐	435000-30	Carbon Dioxide (100 psig)
			☐	435000-31	Argon

BeaconMedæs
1800 Overview Drive
Rock Hill, SC 29730
Phone: (803) 817-5600
Fax: (803) 817-5750
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APPENDIX F

STRUCTURAL CALCULATIONS

Current Date: 3/27/2013 10:36 AM
Units system: English
File name: P:\0499_DVA\1-0499-0019 Lebanon CT-Radiology\1_Admin\3_Engineering\c_Structural\Dunnage Frame.etz\

Geometry data

GLOSSARY

Cb22, Cb33	: Moment gradient coefficients
Cm22, Cm33	: Coefficients applied to bending term in interaction formula
d0	: Tapered member section depth at J end of member
DJX	: Rigid end offset distance measured from J node in axis X
DJY	: Rigid end offset distance measured from J node in axis Y
DJZ	: Rigid end offset distance measured from J node in axis Z
DKX	: Rigid end offset distance measured from K node in axis X
DKY	: Rigid end offset distance measured from K node in axis Y
DKZ	: Rigid end offset distance measured from K node in axis Z
dL	: Tapered member section depth at K end of member
Ig factor	: Inertia reduction factor (Effective Inertia/Gross Inertia) for reinforced concrete members
K22	: Effective length factor about axis 2
K33	: Effective length factor about axis 3
L22	: Member length for calculation of axial capacity
L33	: Member length for calculation of axial capacity
LB pos	: Lateral unbraced length of the compression flange in the positive side of local axis 2
LB neg	: Lateral unbraced length of the compression flange in the negative side of local axis 2
RX	: Rotation about X
RY	: Rotation about Y
RZ	: Rotation about Z
TO	: 1 = Tension only member 0 = Normal member
TX	: Translation in X
TY	: Translation in Y
TZ	: Translation in Z

Nodes

Node	X [ft]	Y [ft]	Z [ft]	Rigid Floor
1	0.00	4.00	0.00	0
2	20.00	4.00	3.5625	0
3	0.00	4.00	3.5625	0
4	0.00	4.00	15.37	0
5	20.00	4.00	15.37	0
6	0.00	4.00	29.557	0
7	20.00	4.00	29.557	0
8	0.00	4.00	41.90	0
9	0.00	0.00	0.00	0
10	0.00	0.00	15.37	0
11	20.00	0.00	3.5625	0
12	20.00	0.00	29.557	0
13	0.00	0.00	41.90	0
14	11.00	4.00	3.5625	0
15	11.00	4.00	15.37	0
16	11.00	4.00	29.557	0
18	11.00	4.00	9.46	0
20	11.00	4.00	22.46	0
21	15.833	4.00	29.557	0
22	17.65	4.00	29.557	0
24	15.833	4.00	22.46	0
25	15.833	4.00	15.37	0

28	15.833	4.00	9.46	0
29	15.833	4.00	3.5625	0
30	15.833	4.00	34.137	0
34	17.65	4.00	3.5625	0
35	15.833	4.00	0.00	0
36	20.00	4.00	0.00	0
37	15.833	4.00	-2.15	0
39	0.00	2.00	41.90	0
40	0.00	4.00	39.90	0
41	0.00	2.00	15.37	0
42	0.00	4.00	17.37	0
43	0.00	4.00	13.37	0
44	2.00	4.00	15.37	0
45	20.00	2.00	29.557	0
46	20.00	4.00	27.557	0
47	0.00	2.00	0.00	0
48	0.00	4.00	2.00	0
49	20.00	2.00	3.5625	0
50	20.00	4.00	5.5625	0
64	20.00	4.00	22.46	0
65	20.00	4.00	9.46	0
66	20.00	4.00	-2.15	0
67	20.00	4.00	34.137	0

Restraints

Node	TX	TY	TZ	RX	RY	RZ
9	1	1	1	0	0	0
10	1	1	1	0	0	0
11	1	1	1	0	0	0
12	1	1	1	0	0	0
13	1	1	1	0	0	0

Members

Member	NJ	NK	Description	Section	Material	d0 [in]	dL [in]	lg factor
1	1	9	COL1	HSS_SQR 6X6X3_8	A500 GrB rectangular	0.00	0.00	0.00
2	2	11	COL1	HSS_SQR 6X6X3_8	A500 GrB rectangular	0.00	0.00	0.00
3	4	10	COL1	HSS_SQR 6X6X3_8	A500 GrB rectangular	0.00	0.00	0.00
4	7	12	COL1	HSS_SQR 6X6X3_8	A500 GrB rectangular	0.00	0.00	0.00
5	8	13	COL1	HSS_SQR 6X6X3_8	A500 GrB rectangular	0.00	0.00	0.00
6	4	8	BEAM1	W 8X24	A992 Gr50	0.00	0.00	0.00
7	4	1	BEAM1	W 8X24	A992 Gr50	0.00	0.00	0.00
8	66	67	BEAM3	W 8X24	A992 Gr50	0.00	0.00	0.00
9	6	7	BEAM1	W 8X24	A992 Gr50	0.00	0.00	0.00
11	4	5	BEAM1	W 8X24	A992 Gr50	0.00	0.00	0.00
13	3	2	BEAM1	W 8X24	A992 Gr50	0.00	0.00	0.00
14	14	15	BEAM1	W 8X24	A992 Gr50	0.00	0.00	0.00
15	15	16	BEAM1	W 8X24	A992 Gr50	0.00	0.00	0.00
18	21	25	BEAM1	W 8X24	A992 Gr50	0.00	0.00	0.00

20	25	29	BEAM1	W 8X24	A992 Gr50	0.00	0.00	0.00
26	28	65	BEAM2	W 8X10	A992 Gr50	0.00	0.00	0.00
27	24	64	BEAM2	W 8X10	A992 Gr50	0.00	0.00	0.00
45	30	67	BEAM2	W 8X10	A992 Gr50	0.00	0.00	0.00
51	35	36	BEAM2	W 8X10	A992 Gr50	0.00	0.00	0.00
52	37	66	BEAM2	W 8X10	A992 Gr50	0.00	0.00	0.00
57	39	40	BRACE7	L 3X3X3_8	A36	0.00	0.00	0.00
58	41	42	BRACE7	L 3X3X3_8	A36	0.00	0.00	0.00
59	41	44	BRACE7	L 3X3X3_8	A36	0.00	0.00	0.00
60	41	43	BRACE7	L 3X3X3_8	A36	0.00	0.00	0.00
61	47	48	BRACE7	L 3X3X3_8	A36	0.00	0.00	0.00
62	45	22	BRACE7	L 3X3X3_8	A36	0.00	0.00	0.00
63	45	46	BRACE7	L 3X3X3_8	A36	0.00	0.00	0.00
64	34	49	BRACE7	L 3X3X3_8	A36	0.00	0.00	0.00
65	49	50	BRACE7	L 3X3X3_8	A36	0.00	0.00	0.00
69	8	16	BEAM1	W 8X10	A992 Gr50	0.00	0.00	0.00
70	1	14	BEAM2	W 8X10	A992 Gr50	0.00	0.00	0.00
89	20	24	BEAM2	W 8X10	A992 Gr50	0.00	0.00	0.00
91	18	28	BEAM2	W 8X10	A992 Gr50	0.00	0.00	0.00
93	16	30	BEAM4	W 8X10	A992 Gr50	0.00	0.00	0.00
94	7	24	BRACE1	L 3X3X3_8	A36	0.00	0.00	0.00
95	28	2	BRACE1	L 3X3X3_8	A36	0.00	0.00	0.00
96	2	35	BRACE2	L 3X3X3_8	A36	0.00	0.00	0.00
97	5	24	BRACE1	L 3X3X3_8	A36	0.00	0.00	0.00
98	5	28	BRACE1	L 3X3X3_8	A36	0.00	0.00	0.00
99	16	24	BRACE1	L 3X3X3_8	A36	0.00	0.00	0.00
100	15	24	BRACE1	L 3X3X3_8	A36	0.00	0.00	0.00
101	15	28	BRACE1	L 3X3X3_8	A36	0.00	0.00	0.00
102	14	28	BRACE1	L 3X3X3_8	A36	0.00	0.00	0.00
103	21	30	BEAM1	W 8X24	A992 Gr50	0.00	0.00	0.00
104	29	37	BEAM1	W 8X24	A992 Gr50	0.00	0.00	0.00

Hinges

	Node-J				Node-K						
Member	**M33**	**M22**	**V3**	**V2**	**M33**	**M22**	**V3**	**V2**	**TOR**	**AXL**	**Axial rigidity**
6	1	1	0	0	1	1	0	0	0	0	Full
7	1	1	0	0	1	1	0	0	0	0	Full
8	1	1	0	0	1	1	0	0	0	0	Full
9	1	1	0	0	1	1	0	0	0	0	Full
11	1	1	0	0	1	1	0	0	0	0	Full
13	1	1	0	0	1	1	0	0	0	0	Full
14	1	1	0	0	1	1	0	0	0	0	Full
15	1	1	0	0	1	1	0	0	0	0	Full
18	0	0	0	0	1	1	0	0	0	0	Full
20	1	1	0	0	0	0	0	0	0	0	Full
26	1	1	0	0	1	1	0	0	0	0	Full
27	1	1	0	0	1	1	0	0	0	0	Full
51	1	1	0	0	1	1	0	0	0	0	Full
57	1	1	0	0	1	1	0	0	0	0	Full
58	1	1	0	0	1	1	0	0	0	0	Full
59	1	1	0	0	1	1	0	0	0	0	Full
60	1	1	0	0	1	1	0	0	0	0	Full
61	1	1	0	0	1	1	0	0	0	0	Full
62	1	1	0	0	1	1	0	0	0	0	Full

63	1	1	0	0	1	1	0	0	0	0	Full
64	1	1	0	0	1	1	0	0	0	0	Full
65	1	1	0	0	1	1	0	0	0	0	Full
69	1	1	0	0	1	1	0	0	0	0	Tension only
70	1	1	0	0	1	1	0	0	0	0	Full
89	1	1	0	0	1	1	0	0	0	0	Full
91	1	1	0	0	1	1	0	0	0	0	Full
93	1	1	0	0	1	1	0	0	0	0	Full
94	1	1	0	0	1	1	0	0	0	0	Full
95	1	1	0	0	1	1	0	0	0	0	Full
96	1	1	0	0	1	1	0	0	0	0	Full
97	1	1	0	0	1	1	0	0	0	0	Full
98	1	1	0	0	1	1	0	0	0	0	Full
103	0	0	0	0	1	1	0	0	0	0	Full
104	0	0	0	0	1	1	0	0	0	0	Full

Current Date: 3/27/2013 10:37 AM
Units system: English
File name: P:\0499_DVA\1-0499-0019 Lebanon CT-Radiology\1_Admin\3_Engineering\c_Structural\Dunnage Frame.etz\

Load data

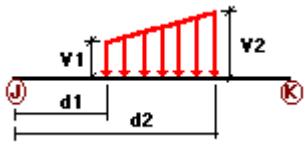
GLOSSARY

Comb : Indicates if load condition is a load combination

Load conditions

Condition	Description	Comb.	Category
DL	Dead Load	No	DL
SL	Snow Load	No	SNOW
Wx	Wind in X	No	WIND
Wz	Wind in Z	No	WIND
LL	Live Load	No	LL
Wx2	Wind in X Opp	No	WIND
Wz2	Wind in Z Opp	No	WIND
EQz	Seismic in Z	No	EQ
EQz2	Seismic in Z Opp	No	EQ

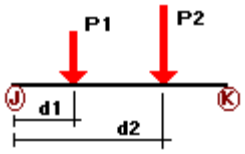
Distributed force on members



Condition	Member	Dir1	Val1 [Kip/ft]	Val2 [Kip/ft]	Dist1 [ft]	%	Dist2 [ft]	%
DL	8	y	-0.08	0.00	0.00	No	0.00	No
	13	y	-0.01	-0.01	11.00	No	15.8333	No
	14	y	-0.03	0.00	0.00	No	0.00	No
	15	y	-0.03	0.00	0.00	No	0.00	No
	18	y	-0.10	0.00	0.00	No	0.00	No
	20	y	-0.10	0.00	0.00	No	0.00	No
	93	y	-0.02	0.00	0.00	No	0.00	No
	103	y	-0.09	0.00	0.00	No	0.00	No
	104	y	-0.08	0.00	0.00	No	0.00	No
SL	8	y	-0.064	0.00	0.00	No	0.00	No
	18	y	-0.064	0.00	0.00	No	0.00	No
	20	y	-0.064	0.00	0.00	No	0.00	No
	103	y	-0.064	0.00	0.00	No	0.00	No
	104	y	-0.064	0.00	0.00	No	0.00	No
Wx	18	x	0.123	0.00	0.00	No	0.00	No
	20	x	0.123	0.00	0.00	No	0.00	No
	103	x	0.123	0.00	0.00	No	0.00	No
	104	x	0.123	0.00	0.00	No	0.00	No
Wz	52	z	0.123	0.00	0.00	No	0.00	No
LL	14	y	-0.10	0.00	0.00	No	0.00	No

	15	y	-0.10	0.00	0.00	No	0.00	No
	18	y	-0.10	0.00	0.00	No	0.00	No
	20	y	-0.10	0.00	0.00	No	0.00	No
	93	y	-0.06	0.00	0.00	No	0.00	No
	103	y	-0.06	0.00	0.00	No	0.00	No
Wx2	8	x	-0.123	0.00	0.00	No	0.00	No
Wz2	45	z	-0.123	0.00	0.00	No	0.00	No

Concentrated forces on members



Condition	Member	Dir1	Value1 [Kip]	Dist1 [ft]	%
LL	13	y	-0.30	13.40	No
	93	y	-0.30	3.30	No
EQz	1	z	0.30	0.00	No
	2	z	1.00	0.00	No
EQz2	4	z	-1.00	0.00	No
	5	z	-0.30	0.00	No

Self weight multipliers for load conditions

Condition	Description	Self weight multiplier			
		Comb.	MultX	MultY	MultZ
DL	Dead Load	No	0.00	-1.00	0.00
SL	Snow Load	No	0.00	0.00	0.00
Wx	Wind in X	No	0.00	0.00	0.00
Wz	Wind in Z	No	0.00	0.00	0.00
LL	Live Load	No	0.00	0.00	0.00
Wx2	Wind in X Opp	No	0.00	0.00	0.00
Wz2	Wind in Z Opp	No	0.00	0.00	0.00
EQz	Seismic in Z	No	0.00	0.00	0.00
EQz2	Seismic in Z Opp	No	0.00	0.00	0.00

Earthquake (Dynamic analysis only)

Condition	a/g	Ang. [Deg]	Damp. [%]
DL	0.00	0.00	0.00
SL	0.00	0.00	0.00
Wx	0.00	0.00	0.00
Wz	0.00	0.00	0.00
LL	0.00	0.00	0.00
Wx2	0.00	0.00	0.00
Wz2	0.00	0.00	0.00
EQz	0.00	0.00	0.00
EQz2	0.00	0.00	0.00

Current Date: 3/27/2013 10:38 AM
Units system: English
File name: P:\0499_DVA\1-0499-0019 Lebanon CT-Radiology\1_Admin\3_Engineering\c_Structural\Dunnage Frame.etz\

Steel Code Check

Report: Summary - Group by member

Load conditions to be included in design :

D1=DL
D2=DL+LL
D3=DL+SL
D4=DL+0.75LL
D5=DL+0.75SL
D6=DL+0.75SL+0.75LL
D7=DL+Wx
D8=DL+Wz
D9=DL
D10=DL
D11=DL+0.75Wx+0.75LL
D12=DL+0.75Wz+0.75LL
D13=DL+0.75SL+0.75Wx
D14=DL+0.75SL+0.75Wz
D15=DL+0.75SL+0.75Wx+0.75LL
D16=DL+0.75SL+0.75Wz+0.75LL
D17=DL+0.75LL
D18=DL+0.75LL
D19=DL+0.75SL
D20=DL+0.75SL
D21=DL+0.75SL+0.75LL
D22=DL+0.75SL+0.75LL
D23=0.6DL+Wx
D24=0.6DL+Wz
D25=0.6DL
D26=0.6DL
D27=DL+Wx2
D28=DL+Wz2
D29=DL+0.75LL+0.75Wx2
D30=DL+0.75LL+0.75Wz2
D31=DL+0.75SL+0.75Wx2
D32=DL+0.75SL+0.75Wz2
D33=DL+0.75SL+0.75LL+0.75Wx2
D34=DL+0.75SL+0.75LL+0.75Wz2
D35=0.6DL+Wx2
D36=0.6DL+Wz2
D37=DL+0.7EQz
D38=DL+0.7EQz2
D39=DL+0.525EQz+0.75LL
D40=DL+0.525EQz2+0.75LL
D41=DL+0.525EQz+0.75SL
D42=DL+0.525EQz2+0.75SL
D43=DL+0.525EQz+0.75LL+0.75SL
D44=DL+0.525EQz2+0.75LL+0.75SL
D45=0.6DL+0.7EQz
D46=0.6DL+0.7EQz2

Description	Section	Member	Ctrl Eq.	Ratio	Status	Reference
BEAM1	***W 8X10***	**69**	D34 at 50.00%	**0.06**	**OK**	Eq. H1-1b
	W 8X24	**6**	D33 at 53.13%	0.13	OK	Eq. H1-1b
		7	D33 at 76.56%	0.03	OK	Eq. H1-1b
		9	D33 at 54.69%	0.28	OK	Eq. H1-1b
		11	D33 at 10.94%	**0.39**	**OK**	Eq. H1-1b
		13	D33 at 54.69%	0.20	OK	Eq. H1-1b
		14	D2 at 50.00%	0.05	OK	Eq. H1-1b
		15	D2 at 50.00%	0.08	OK	Eq. H1-1b
		18	D15 at 50.00%	0.11	OK	Eq. H1-1b
		20	D15 at 50.00%	0.08	OK	Eq. H1-1b
		103	D15 at 0.00%	0.09	OK	Eq. H1-1b
		104	D15 at 0.00%	0.06	OK	Eq. H1-1b
BEAM2	***W 8X10***	**26**	D35 at 0.00%	0.01	OK	Sec. E1
		27	D35 at 0.00%	0.01	OK	Sec. E1
		45	D28 at 50.00%	**0.07**	**OK**	Eq. H1-1b
		51	D27 at 0.00%	0.01	OK	Sec. E1
		52	D8 at 50.00%	0.07	OK	Eq. H1-1b
		70	D34 at 50.00%	0.02	OK	Eq. H1-1b
		89	D7 at 50.00%	0.00	OK	Eq. H1-1b
		91	D27 at 50.00%	0.00	OK	Eq. H1-1b
BEAM3	***W 8X24***	**8**	D15 at 48.61%	**0.24**	**OK**	Eq. H1-1b
BEAM4	***W 8X10***	**93**	D2 at 50.00%	**0.05**	**OK**	Eq. H1-1b
BRACE1	***L 3X3X3_8***	**94**	D15 at 50.00%	0.24	OK	Eq. H1-1a
		95	D15 at 0.00%	0.18	OK	Sec. E1
		97	D33 at 50.00%	0.06	OK	Eq. H1-1b
		98	D34 at 50.00%	0.05	OK	Eq. H1-1b
		99	D33 at 100.00%	0.16	OK	Eq. H1-1b
		100	D33 at 100.00%	0.40	OK	Eq. H1-1a
		101	D33 at 100.00%	0.28	OK	Eq. H1-1b
		102	D33 at 100.00%	0.15	OK	Eq. H1-1b
BRACE2		**96**	D7 at 50.00%	0.03	OK	Eq. H1-1b
BRACE7		**57**	D33 at 0.00%	0.13	OK	Sec. E1
		58	D33 at 0.00%	0.14	OK	Sec. E1
		59	D33 at 50.00%	**0.58**	**OK**	Eq. H1-1a
		60	D33 at 0.00%	0.04	OK	Sec. E1
		61	D33 at 0.00%	0.05	OK	Sec. E1
		62	D15 at 50.00%	0.32	OK	Eq. H1-1a
		63	D43 at 50.00%	0.36	OK	Eq. H1-1a
		64	D15 at 50.00%	0.35	OK	Eq. H1-1a
		65	D44 at 50.00%	0.36	OK	Eq. H1-1a
COL1	***HSS_SQR 6X6X3_8***	**1**	D33 at 50.00%	0.03	OK	Eq. H1-1b
		2	D15 at 50.00%	**0.43**	**OK**	Eq. H1-1b
		3	D33 at 50.00%	0.40	OK	Eq. H1-1b
		4	D15 at 50.00%	0.43	OK	Eq. H1-1b
		5	D33 at 50.00%	0.08	OK	Eq. H1-1b